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BEE CULTURE

BY

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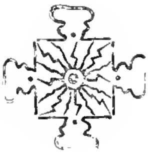
PREFACE.

Harrisburg, Pa., April 1, 1901.

The following Bulletin, No. 77, by Dr. C. C. Miller, of Marengo, Ill., upon the subject of "Bee Culture," was undertaken at the instance of this Department to meet a want, which has been expressed by many correspondents, for information upon this industry.

Dr. Miller is a well-known authority upon bees, and is thoroughly conversant with all that relates to their management and care. Those who are interested in this subject will find this Bulletin full of valuable suggestions.

JOHN HAMILTON,
Secretary of Agriculture.



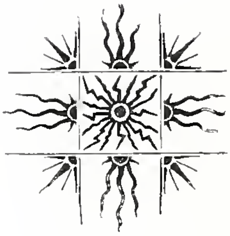
LETTER OF TRANSMITTAL.

Hon. John Hamilton, Secretary of Agriculture, Harrisburg, Pa.:

Dear Sir: I have the honor to transmit herewith some plain instructions in bee-keeping which, I trust, may help to popularize that somewhat neglected branch of agriculture. No attempt has been made to write a complete treatise on bee culture, which would be impossible in the limits prescribed. The effort has been rather to put in as clear a manner as possible those things that would be of most practical use to one with little or no knowledge upon the subject. There has been constantly kept in mind the needs of the farmer whose time is already taken up with many cares, and to make plain how, with the least expenditure of time and labor, he may secure the fertilization of his blossoms, and at the same time secure for his table one of the most wholesome as well as most delicious articles of food that can grace the table of the epicure and millionaire.

Very respectfully,
C. C. MILLER.

Marengo, Ill., April 1, 1901.



BEE CULTURE.

By Dr. C. C. Miller, *Marengo, Ill.*

VALUE OF HONEY.

Sixty pounds of sugar annually for every man, woman and child is the estimated consumption for the United States. Of course, many fall far short of that amount, but others as much exceed it. Among these latter may be found many a one who pays dearly for pandering too much to his sweet tooth. Excessive use of sugar has, in its train, a long list of ills as sour stomach and various forms of dyspepsia; and it is also credited with being one of the causes of that dread visitant, Bright's disease of the kidneys. When cane sugar is eaten, it must be changed into grape sugar by digestion before it can be assimilated. If too much of this work is thrown upon the stomach, it rebels, and the work is passed over to the kidneys. If the kidneys are overtasked, there is no other organ to which the work can be transferred, and a breakdown is the result.

Yet the universal craving for sweets, especially among the young, shows that there is a real want which should be supplied. Fortunately, the want can be supplied without the dangers attendant upon the use of sugar. Instead of cane sugar, honey contains grape sugar, and its use brings no hard burden upon either stomach or kidney. Honey is nature's own sweet, delicately flavored as no confectioner could flavor it. To the natural taste of the child it is an esteemed luxury. Instead of an occasional indulgence, with the danger of a surfeit, children should be allowed honey as a daily food. A pound of honey will go as far as a pound of butter, and costs less. Bread and honey—not bread and butter and honey, but bread and honey—is a wholesome ration for a child, and a freer use of it would give us stronger men and women. Instances are not lacking in which those who have attained to an unusual old age attribute their long life to the daily use of honey. Whether they are right or wrong in their opinion, the fact remains that they have attained great age while making honey a regular article of diet.

So accustomed have we become to the use of sugar that we are likely to consider it an indispensable article, whereas for thousands of years sugar was unknown, honey being almost the sole sweet until within a few centuries, and many are now living who remember the time when the now commonly known granulated sugar was too high in price to be used as at present daily in the poorest families. It were better for the health of the nation if in this respect we could go back to the former times, making honey take the place, at least partially, of sugar.

As a medicine, honey formerly filled a large place, and is still esteemed. In cookery, it has the distinct advantage over sugar that it has an affinity for moisture, and so honey jumbles and other dainties prepared with honey will keep months or years, whereas the same articles made with sugar would be dry and soon unpalatable.

BEES AS HONEY-GATHERERS.

For obtaining honey, we are entirely dependent upon the honey-bee. The amount to be obtained from bumblebees is so small as to be unworthy of consideration. Strictly speaking, the bee does not gather honey, but nectar. Compared with honey, nectar is a very insipid affair, and the bee performs the part of both cook and chemist in evaporating it down to the proper consistency, changing its cane sugar to grape sugar, and adding a minute quantity of formic acid. Flitting from flower to flower, busily gathering a very small quantity from each, never stopping to rest on a flower but for a fraction of a second, it fills its honey sac and hastens home to add its quota to the general store.

One uninformed would hardy credit the bee with the amount of labor performed and the distance traveled to obtain a load of nectar. Instead of searching for plunder near its hive, it often flies half a mile, a mile, two miles, and some believe that it goes from three to six miles from choice. A colony of bees, that is a family of bees occupying a single hive, may be kept on a very small piece of land, say two to four square feet, but if its flight were confined to that, or to an acre, or even ten acres, it would die of starvation. Of course, the case would be different if the ground were closely occupied with some great yielder of honey, such as buckwheat.

Taking the State of Pennsylvania as a whole, it is doubtful that there are many places where it would be prudent to put more than one hundred colonies in a single apiary. More than that would overstock the field. If now we estimate that the bees skirmish in all directions to a distance of two and one-quarter miles from home, the total territory occupied will be a little short of sixteen square miles —just about 100 acres to each colony.

BEES AS FLOWER-FERTILIZERS.

However important the work of the bee in securing the delicious honey, that is not its most important work. The honey-bee has been very aptly termed "the marriage-priest of the flowers." In order that fruit and seed may be produced, the pollen must be carried from stamen to pistil, this work being done in some cases by the wind, in other by insects, chief of which is the busy bee. Every observing farmer lad has noticed that on a cucumber, squash or pumpkin vine there are two kinds of blossoms, which he probably designates as "false" and "true." The true or pistillate blossom, before it opens, shows at its base the miniature fruit, which grows and matures, providing the pollen is brought from a false or staminate blossom. If the pistillate blossom be covered with mosquito netting, so that no insect can reach it to bring the pollen, the little fruit will "blast," or shrivel up and drop off.

Many plants, however, have what are called perfect blossoms; that is, stamens and pistils are found in the same blossom. Why should any go-between be needed for in such a case? Even in this case, an all-wise Creator has so arranged that the pollen of any given flower shall not be used to fertilize the pistil of the same flower, for too close breeding of this kind is sure to bring deterioration. Take the apple. An apple blossom has stamens and pistils on the same flower. In order to fertilization, the pollen must be ripe, and the stigma of the pistil must also be ripe or in a receptive condition. It is wisely ordered that the times of ripening of the two do not coincide. So, when the stigma is ready to receive the pollen, no pollen is ready on the same blossom, and it must depend on having pollen brought from other blossoms. The honey-bee is the chief operator in this case. If a portion of an apple tree be enclosed in a netting at the time of blooming, the part thus enclosed will show very little fruit. If, at the time of blooming, the weather be rainy or bad, so that bees can fly but little or not at all, the apple crop to that extent may be counted a failure. If white clover blossoms be covered by netting, those so covered will mature only a fractional part of their seed as compared with those left open.

THE PROFITS OF BEE-KEEPING.

These are generally considered without any reference to the great profit of the bees in fertilizing plants, the value of honey alone being usually considered. Beeswax is, however, a product of no mean importance. If bees are left to themselves, it is not an uncommon thing for a colony to send out two or more swarms in a season. If we limit the number of swarms to two, that will triple the number of colonies. So a man who begins with one colony, will have three colonies with which to begin the second year. Then he will have successively to begin each year, 9, 27, 81, 243, 729, 2,187, 6,561, and the tenth year he will begin the season with 19,683 colonies to work for him. A single colony has gathered 200 pounds of honey or more, and at 20 cents a pound, that makes $40.00 per colony, and the total yield from 19,683 colonies will give the snug sum of $787,329.00, to say nothing of all the crops he has had in previous years.

Certainly that looks very attractive on paper, and the glib-tongued patent-hive vender can add embellishments by saying that with his hive even better results can be obtained; that there are many cases on record in which 200 pounds per colony have been exceeded, and in some cases 500 or 600 pounds has been the figure. He may also say that three, four and even five or six swarms have been known to issue from one colony in a season. But there are some things he does not mention. He does not mention that the cases he gives are very exceptional cases; that instead of such a continuous flow of success, years of failure may be expected, in which the bees will fail to gather their own living, and will all die if not fed, and that the wonderful yields mentioned are very few and far between, occurring in remarkable localities that fall outside the State of Pennsylvania.

As a matter of fact, no such results as given in the figures mentioned have ever been obtained, and it is morally certain that they never will be obtained. If more than one swarm issues from a colony, the likelihood is that all after the first will be weaklings, of little value that will not survive the winter. If from any considerable number of colonies, a man obtains for a series of years an average of thirty pounds per colony, he has not reason to complain, and if his yearly average reaches fifty he has something to boast of. The man in search of a fortune need hardly turn to bee-keeping, and the number is small of those who depend on bee-keeping alone for a livelihood.

And yet it is true that in many a case there is nothing about a farm that pays better for the capital invested and the amount of labor involved than bee-keeping. If a professional bee-keeper near by has an apiary of fifty or more colonies, depending largely upon them for a living, it may be part of kindness and of wisdom for you to have nothing to do with bees. If the territory is already occupied by his bees, your flowers will be properly fertilized with no care on your part, and every additional colony you plant will be just so much taken from his income without a corresponding addition to you own. But if the territory is unoccupied, you may find profit in keeping at least a few colonies.

OVERSTOCKING THE FIELD.

For the number of colonies on any given territory makes a decided difference as to results, and it is not a very difficult thing to overstock the field. Suppose a man has in one apiary 50 colonies, and that they gather all the nectar within the radius of their flight, giving their owner a harvest of 40 pounds per colony. That makes a total of 2,000 pounds. But that is not all the honey those bees gather. In addition to the surplus honey taken, they gather enough for their own consumption, and that is estimated to be not less than 60 pounds per colony. So the 50 colonies would gather an additional 3,000 pounds for their own consumption, making the total amount of their gathering 5,000 pounds.

Now suppose this man's nearest neighbors on four sides of him should each plant an apiary of 10 colonies, making 40 colonies to be added to his, or 90 colonies in all to occupy the field. The total yield of the field is as before, 5,000 pounds. This, divided among the 90 colonies, gives less than 60 pounds per colony, or less than the bees need for their own existence, leaving both the man and his neighbors without any surplus honey, but obliged to feed to finish out the winter stores of the bees.

Localities differ greatly. One man in California has 600 colonies in one apiary. But that is in a remarkable locality, and it is just possible that he might get more surplus with a smaller number of colonies. The localities in Pennsylvania where more than 100 colonies can be profitably kept in one apiary are probably very few. In more places, from 50 to 75 should be the limit. One trouble in the case is that it is very hard to come to any definite conclusion. A given number may be all right for one year, then the next season will be so poor that half the number would give a greater surplus.

THE BEST LOCATIONS.

There are locations, however, where a few colonies may be relied upon to give a handsome return year after year. If you can find a place where there are very few bees within a range of two or three miles, and where there are many honey-plants blooming at different times throughout the season, you may count on a good crop every year. It is true that some good honey-plants bloom freely some seasons and yield no honey, and perhaps the next season, with no greater show of bloom, they may yield abundantly. But there is little danger that all will fail in the same year. If white clover is a failure, linden may more than compensate, or it may be a good year for buckwheat.

In this connection it may not be amiss to offer a word of caution. If you should strike upon a locality of this kind, and get an extra-ordinary yield with only one or two colonies, do not make the mistake to think that because you get 150 pounds per colony you can count on doing the same thing if you should increase to 50 or 100 colonies. A great variety of plants helped to make that 150 pounds, some of them yielding only a small amount, but enough so that one or two colonies could find employment every day throughout the season. When you increase to 10 colonies, there will be days when the plants are yielding at the time will yield no more than the bees need for their own support; and when you increase to 50 or 75, there will be only a short period when the bees get more than their living. It is a comfort to know, however, that when the harvest is rich, that a short period will be sufficient to make a handsome return for all the year's work. In the State of New York, G. M. Doolittle reports a yield of 66 pounds of linden honey from one colony in three days. That is very unusual, but even with 5 or 10 pounds per day, it would need only a few days to make a fine return. The harvest from linden may last two or three days, or it may last three or four weeks.

KINDS OF HONEY.

There are as many kinds of honey as there are of plants from which it is gathered. It may be dark in color, then it may be light; it may be strongly flavored, or so mild as to be almost a pure sweet, and as varied in flavor as the different plants vary. Generally speaking, honey of light color brings the highest price, although there are persons who prefer the darker and stronger-flavored honey, for dark color and strong flavor are likely to go together.

White-clover honey is the great staple. In quality, the great majority of people will place it at the head. It also leads as to amount, taking the State at large. A stray blossom of white clover may be seen here and there toward the latter part of May, and in about ten days later the bees will be found busy storing from it. That is, if it yields honey. For it may bloom abundantly and the bees find no nectar in the flowers, because of atmospheric conditions, or for some other reason. In a good season the bees store most rapidly at a time when farmers just begin to complain of drought. Usually the white-clover harvest covers a period of three or four weeks, although it may be half as long, or it may be twice as long. Alsike clover exceeds white in yield. Sweet clover is coming to the front as an important honey and forage plant.

Linden, or basswood, also yields a white or very light amber honey, of a flavor that is highly esteemed, and in very many cases it is classed as white-clover honey. In rapidity of yield no other plant surpasses it, as already mention. With a good range of linden timber, one may do fairly well with ten days of harvest, even if not a drop of surplus comes from any other source. Its usual season is July.

Buckwheat is the chief source of dark honey. In some locations it is quite reliable, yielding a rich harvest of dark honey, quite strong in taste and smell, while in others it is capricious, failing entirely to yield in some years. The daily yield from buckwheat is only in the forenoon. As it is not usually sown until July, it is classed as a fall honey-plant.

Fruit bloom and dandelions are important, not because they yield a large amount of surplus, for it is a rare thing to obtain surplus from them, but because they come early in the season to help fill up the hive with brood for young bees that shall be ready for the white honey harvest.

For the same reason the maples and the different varieties of willows are valuable.

Near the last of May the tulip-tree, which is also called whitewood or poplar, puts forth its beautiful flowers, which yield much dark honey.

Space forbids consideration of many other plants of more or less importance as honey-yielders, among which may be mentioned boneset or thoroughwort, catnip, cucumber, elm, figwort, ground-ivy, service-berry, locust, mustard, pleurisy-root, pumpkin and sun-flower.

Honey-dew is a secretion of the aphids or plant-lice, which the bees gather from the leaves of hickory and other trees. Some honey-dew is of fair flavor, but generally it is unfit for the table and disastrous to the bees if used for winter stores. Fortunately, the bees do not care to gather it when better stores are to be had.

POLLEN.

Pollen, the fertilizing dust of flowers, is gathered in large quantities by the bees, and although generally little valued by the bee-keeper, is indispensable to the bees. In the spring, if all pollen has been removed from the hive, no brood will be found until there is a supply of pollen from the early flowers, although adjoining colonies may have started brood-rearing in March or February. The nurse bees must have pollen or bee-bread, as it is often called, to prepare the pap that is fed to the baby bees. In order to carry pollen from the flowers to the hive, bees pack it in the pollen baskets on their hind legs. Then it is packed in cells at the outer part of the space occupied by the cluster of bees. The color of pollen varies according to the flowers from which it is taken, as yellow from dandelion and brown from white clover.

PROPOLIS.

Besides honey and pollen, bees gather propolis, or bee-glue, carrying it in their pollen-baskets. As the name bee-glue indicates, it is of a sticky nature, and is used by the bees to glue up all cracks and corners, although sometimes it is varnished over a plain surface, and even over the cappings of comb honey. It is possible that some day popolis may have a commercial value as a medicinal agent, but at present bee-keepers would be glad of a strain of bees that would gather no propolis. When the fingers of the bee-keeper become daubed with propolis, it cannot be washed off with water nor with soap and water. First, smear the part with a little butter or lard, rub well, then wash off all with soap and water.

BEESWAX.

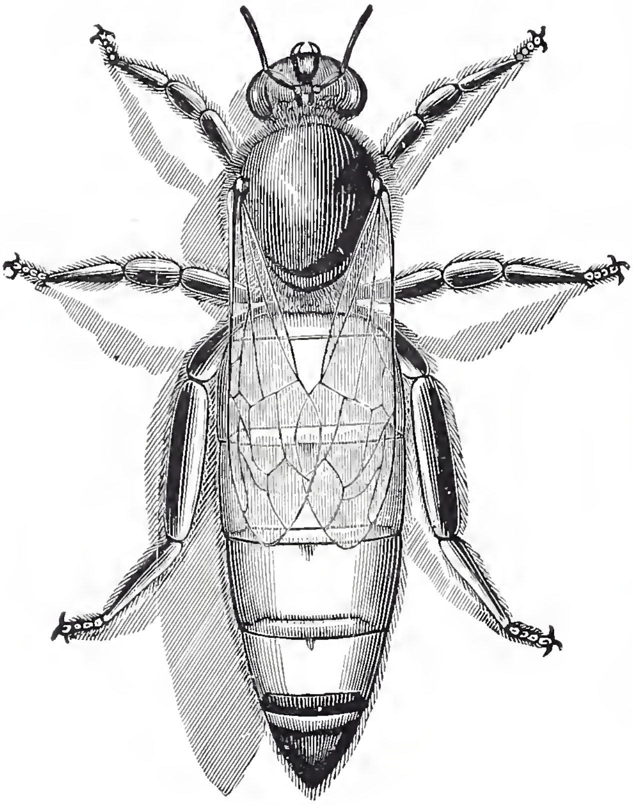
Bees do not gather wax, but secrete it a little after the manner in which a cow secretes milk. The wax is secreted in little flat scales between the rings of the abdomen, somewhat pear-shaped, and beautifully white. As commonly found in commerce, it ranges in color from a bright yellow to almost black. For the production of a pound of beeswax, it is estimated by some that twenty pounds of honey are consumed by the bees, and from that the estimates varies all the way down to three pounds. In any case, the cost is so much that the production of wax is not encouraged by bee-keepers, although as a by-product, if every scrap of wax be carefully saved quite an amount may be accumulated, for which there is always a ready market.

A COLONY OF BEES

Is a single family living together in one hive, working together in the most methodical manner, and each colony is separate from every other colony, each bee loyal to the interests of its own colony and ready at any moment to sacrifice its own life to defend its home against the attacks of other bees or of any other foes, man included. At the beginning of the swarming season a good colony will contain forty or fifty thousand bees, possibly twice as many in rare cases, among which will be found one queen, a few hundred drones, and thousands of workers.

THE QUEEN

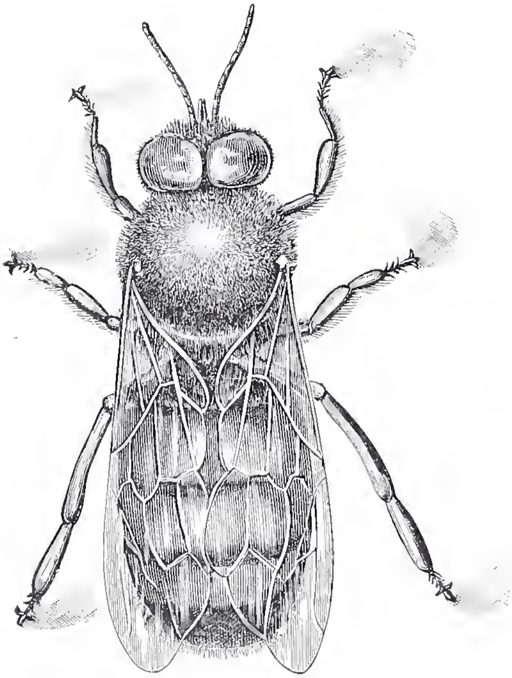
Is not a queen at all in the ordinary acceptation of the term. She does not rule. Her sole business is to lay eggs. Beginning sometimes as early as January or February, she lays a very few eggs in the center of the cluster, and by and by the number is increased to 100 daily; then as the activity of the colony increases with warm weather, the daily laying increases to 200, 500, 1,000, and when all conditions are favorable, the hive being crowded with bees, the flowers yeilding abundance of nectar, the daily output of eggs from one queen may be 3,000 or more. She continues laying until fall. But laying eggs is all she does. When busy at it, she does not even feed herself. The workers offer her food from time to time, and save her the trouble of digesting it by giving her that which is already digested. Nor are these eggs such very small affairs, for they are large enough so that the amount daily laid will exceed the weight of the queen's body, each egg being one-fourteenth of an inch long and one-seventieth of an inch in diameter. The queen is recognized by her longer body and comparatively short wings.



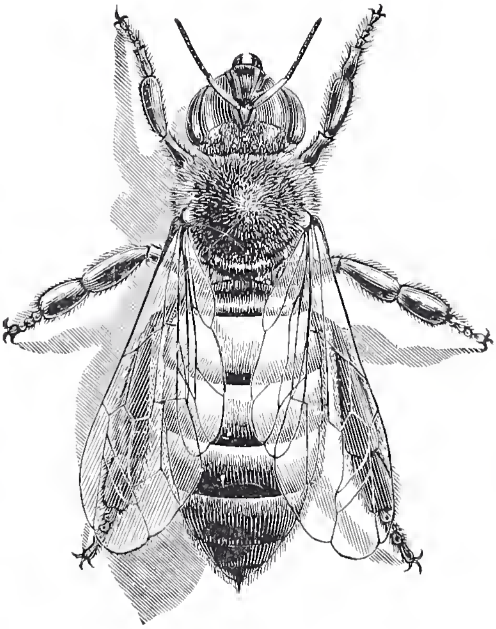
QUEEN.
(By permission from Root's A B C of Bee Culture.)

THE DRONES

Are the male members of the family. Beyond helping to keep up the heat of the hive, they are of no service whatever inside, their sole purpose being to fertilize the queen, the meeting taking place high up in the air. The queen is fertilized once for life, and never again leaves the hive unless it be to go with a swarm, When the harvest is over, the workers withhold food from the drones and they soon disappear.



DRONE.



WORKER.

(By permission from Root's A B C of Bee Culture.)

THE WORKERS

Form the great bulk of the colony. They are smaller than the queen or the bulky drones, and are undeveloped females. Aside from the laying of eggs, they do all the work, bringing in nectar, water, pollen and propolis; secreting the wax and building the combs, and feeding the young, so soon to take their places. They are the only ones that sting. The drones have no sting. The queen has a sting, but she is as safe to handle as a fly, for she will sting nothing but another queen.

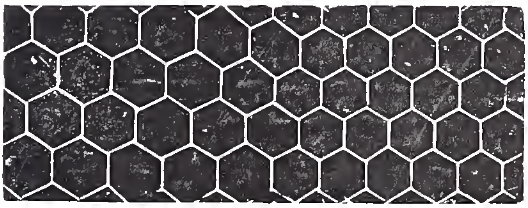
DEVELOPMENT OF BEES.

Three days after an egg is laid, a tiny white grub or larva hatches out of it. For about five days this grub is fed by the nurse bees, when it is sealed up and left to spin its cocoon and develop into the *imago* or perfect insect. Fifteen days from the time the egg is laid, the queen emerges from the cell. At five to eight days of age she is fertilized, and when eight or ten days old she begins to lay. Her span of life is generally two or three years, although queens have been known in rare instances to have lived five or six years. The drone emerges twenty-four days after the egg is laid, and his lease of life depends somewhat upon the wealth of the harvest. If a continued dearth comes early in the season, his days are numbered. If there is honey to be gathered the whole season, his life will be spared until a killing frost, when his thrifty sisters will mercilessly drive him from the hive.

The worker emerges from the cell twenty-one days after the egg is laid. At a very early age she begins the duties of housekeeping, cleaning out the cells, feeding the baby bees, building combs, etc. Bees engaged in this work are called nurse bees. When sixteen days old, the worker begins to go afield, adding to the stores of the hive, and is then called a field bee. The length of life of a worker depends on the time of year when life begins. A worker emerging in June, when hard work is the order of the day, will wear itself out in about six weeks. An old bee is known by its ragged wings, and works until it dies. A worker emerging in September will live a half year or longer, as much of its life is spent in a semi-dormant condition.

HONEY-COMB.

A marvel of workmanship is the honey-comb constructed by the bees, of wax, consisting of a base or septum, with six-sided cells on each side. The greater part of the cells are one-fifth of an inch in diameter, thus making about twenty-nine to the square inch on each side, but as modified by man's interference, twenty-five to the square inch is nearer the mark. These cells are called worker-cells. Drone-cells are one-fourth of an inch in diameter, and there are about eighteen of them to the square inch. Under normal conditions, an egg laid in the smaller or worker-cell will produce a worker, and one laid in a drone-cell will produce a drone. The difference in the eggs is that the egg laid in the worker-cell is impregnated and that laid in the drone-cell is unimpregnated. Worker-comb measures about seven-eighths of an inch in thickness (a little more when it is old), and drone-comb is about one and one-fourth inches thick. That is the measurement when the comb is used for brood-rearing. When used for storing honey it may be thicker, in some instances three inches thick or more. Worker-comb may also be used for storing pollen.



DRONE-COMB. WORKER-COMB.

(By permission from Root's A B C of Bee Culture.)

Queen-cells are constructed when needed, and differ entirely in appearance from other cells. A completed queen-cell looks a good deal like a peanut, and is not far from the same size, having indentations over its surface like a peanut. Instead of opening sidewise, like a worker or drone-cell, it opens downward. When a young queen emerges from a cell, nearly the whole of the cell will be torn down within a few days, never again to be rebuilt.

It is estimated that a pound of wax will make enough comb to contain about twenty pounds of honey.

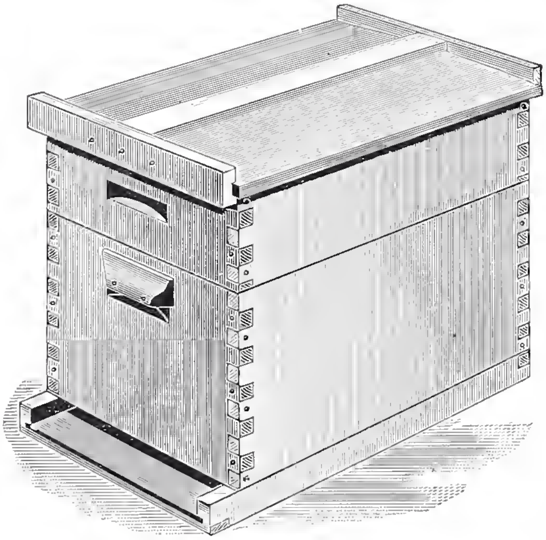
HIVES.

Until about half a century ago, the prevailing bee-hive was of conical shape and made of straw. From the standpoint of the bees' comfort, it is doubtful whether a better hive exists to-day. The practice was to brimstone in the fall the heaviest and lightest colonies, saving those of medium strength for a start the next year. It was a wasteful and barbarous practice, but even with all its wastefulness, it was profitable. The straw hive, or skep, was succeeded by the box hive. Strictly speaking, box hives came into use before straw hives went out. At first box hives were used the same as straw hives, but later surplus boxes or drawers were put on top, and surplus honey was taken out without murdering the bees. About the middle of the nineteenth century, Rev. L. L. Lanstroth invented the movable-frame hive, and to-day most of the hives in this country are of this kind. Each comb is built in a separate frame, so that each can be taken out separately, making it possible for the bee-keeper at any time to examine any part of the inside of the hive —a thing utterly impossible before the invention of Mr. Langstroth.

The kind of hive that is best to use depends a little on what the bee-keeper intends to do. If movable frames are never to be moved, there is not sufficient excuse for their existence. Bees will store as much honey in a box hive or even a nail keg as in a movable-frame hive, and will, perhaps, prosper better in the cheaper hive if having no care, but a hive with movable combs is much more convenient for the bee-keeper, and decidedly the better hive to have if he uses the movable feature.

Hives with movable frames are of various patterns, any of which may be profitably used. It is the man and the management that make differences in results more than the hive. But it is very undesirable to have more than one kind of hives in the same apiary, if you are to use movable frames. If you have a dozen box hives, it may be as well to have a dozen kinds. But one kind of movable-frame hive is enough, no matter what the number in the apiary. At least there should be only one size of frame, so that any frame in the apiary may be taken from its hive and put in any other hive.

The size of frame used more than any other, called the Langstroth frame (although any movable frame might fairly be called a Langstroth frame), is 17⅝ inches in length and 9⅛ inches deep. The most popular form of hive in which this frame is used is the dove-tailed hive, so called because its corners are locked together somewhat after the manner of dove-tailing. The body is little more than a plain box to hold the frames. The beginner will do well to start with the dove-tailed hive, not because it is so much better than all others, but because it is a sort of standard article, made by the thousands by supply manufacturers, and to be obtained at a lower rate, because standard, and also because it can be obtained at any time from some dealer in bee-keeping supplies at no great distance.



DOVE-TAILED HIVE.

(By permission from Root's A B C of Bee Culture.)

If you use box hives, it will be an easy thing for you to make your own hives. It does not matter if no two are exactly alike. But the case is different with movable-frame hives. Very few, indeed, are so situated, as to make a movable hive as good or as cheap as those that are made with the use of special machinery at the large manufactories. In most cases it is better to buy hives in the flat and nail them together yourself. The nailing is a simple matter, and the freight is much less on hives in the flat than on those nailed together.

Some of the advantages of movable combs may be mentioned here. Combs and bees may be interchanged from one hive to another, and the whole of the inside of the hive can be examined, whereas the inside of a box hive is a sealed book. The queen can be found, and if she is a drone-layer, or if the colony is queenless, the fact can be ascertained and steps taken accordingly. If increase is desired and the bees refuse to swarm, the bee-keeper with movable combs can make artificial swarms. Swarming may be to some extent controlled by giving additional room. The production of useless drones may be prevented by allowing little or no drone comb in the hive. Sometimes it happens that the wealth of a colony is its ruin. The combs are all filled with honey, and the queen has no place to lay. With movable combs it is an easy matter to remedy this. But it must be remembered that for the proper use of movable combs, intelligent information on the part of the bee-keeper is necessary, and if the combs are never to be lifted out of the hive it is as well or better to have the bees in a box hive.

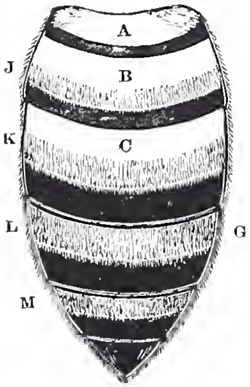
SIZE OF HIVES.

Much diversity of opinion exists as to the size of hives. A box-hive may contain about 2,000 inches, but some prefer a larger size. For 2,000 inches, a good proportion is to have the inside of the hive 12 inches square and 14 inches high. For extracted honey there is a pretty general agreement that a ten-frame movable comb hive is desirable, but for comb honey many prefer a hive of eight frames. But the eight-frame hive needs closer attention as to the matter of supplies, and the ten-frame hive is much safer against the danger of starving in winter and spring. Do not think of using less than ten frames, unless you expect to give close attention to your bees.

ITALIAN AND BLACK BEES.

The common black bee was first introduced into this country; but within the last half of the nineteenth century bees from Italy have become very common, and the Italian bee seems to be the popular variety. In size and form it is much the same as the common bee. The difference in appearance is found in the first three rings of the abdomen. The abdomen of a worker-bee, whether Italian or common, consists of six segments, one segment sliding into the other telescope fashion. When a bee is filled with honey, the abdomen is elongated and the segments show more plainly.

At the left in the engraving is a worker-bee much enlarged, in which the segments of the abdomen are plainly seen. At the right the abdomen is shown alone. The segments A, B, C, are yellow in pure Italian bees that are imported from Italy. The four middle rings in all kinds of workers have the edges covered with light-colored down or plumage, as shown at J, K, L, M, but there is no down on the first or last segment. It is not this down, however, that gives the yellow color to the first three bands in Italian bees, but the horny substance of the segment itself. Some Italian bees have plumage that is nearly white instead of yellow, and these are called albinos. When the down is worn off, as in the case of robber bees, the bees become glossy black, the three first bands of the Italians of course being still yellow.



(By permission from Root's A B C of Bee Culture.)

In this country are to be found what are called golden or fivebanded Italians. They have been obtained by continued selection, so that instead of the three yellow bands there are four and five. They are very beautiful bees, but no better workers because of their beauty.

The important difference between Italians and black bees is in their deportment. It has become well settled that Italians are more industrious, even a small mixture of Italian blood helping to make a difference in the amount of surplus stored. They are more gentle, and with proper handling much less inclined to sting than the blacks. When a comb covered with bees is lifted out of a hive of blacks, the bees run in confused excitement, forming into a sort of rope and finally falling off at the lower corner of the frame, while Italians under the same circumstances remain quietly on the comb, and frequently the queen may be seen to lay while the comb is held in the hand. Italians are greatly superior in defending themselves against the incursions of the bee-moth. Indeed, the owner of Italian bees has no need to pay any attention to bee-moths.

The cross between Italian and black bees, called hybrids, will be found in many cases as good honey-gatherers as the pure Italians; sometimes better. Unfortunately, some of them will be found more vicious stingers than pure blacks. The workers of a first cross will be found to be partly black and partly with three yellow bands, or the bees may have one or two yellow bands. Although hybrids may be as good workers as pure stock, especially the first cross, there is a tendency to deteriorate, and it is well to have a pure queen to breed from.

OTHER VARIETIES OF BEES.

Carniolan bees have been bred to some extent. They are much like blacks in appearance, but the bands of light-colored down are brighter in the Carniolans. Some esteem them and their crosses as industrious workers, but their propensity to excessive swarming is urged against them.

Cyprian bees resemble Italians in appearance, and are good workers but inclined to be extremely vicious. Holy-Land and the Egyptian bees have been tried, but have not been approved. The general verdict is that for greatest profit in bee-keeping it is wise to have as nearly as possible pure Italians.

MAKING A START IN BEE-KEEPING.

If you have no bees, and desire to begin bee-keeping, you will do well to buy a full colony of Italian bees in a movable-comb hive, if you can conveniently do so. If none are to be had in easy distance, you can certainly get them by ordering from some dealer at a distance, but they would have to be sent by express, and that would make them expensive. The expressage would be much less on a nucleus, that is a small colony covering only two or three frames, and such a nucleus could be built up into a strong colony, but so long as you have had no experience in that line it will be much better for you to begin with a full colony. If you want to be at all economical in the matter, do not send off two or three hundred miles for a colony of Italian bees in a movable-frame hive, but get the nearest to it you can get in your own neighborhood, if you can do no better than to get a colony of black bees in a box hive.

Whatever you may buy, you will do well to leave the selection to the man from whom you buy, if he is experienced and at the same time honest. If he lacks in either of these two respects, then you must do the best you can with your own judgment.

Even for the sake of getting a bargain, it will hardly be wise for you to start with more than one or two colonies. Let your numbers grow with your experience.

The probability is that spring is the best time for you to buy. If you have several from which to select, other things being equal, take the one that seems to have the most bees. Take one that feels heavy when you lift it, for a light one may not have enough honey for the bees. One which threw off a swarm the previous year will have the advantage of a young queen.

LOCATION OF APIARY.

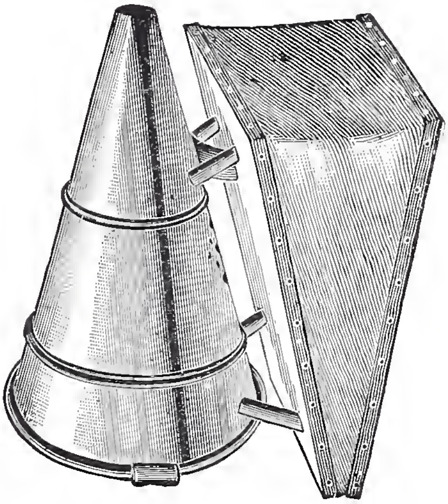
The word "apiary" is used to express the place where bees are kept. It is also, and perhaps oftener, used to mean the bees with all their appurtenances, as "John has an apiary of twenty colonies of bees." If bees are wintered outdoors, and kept in the same place the year around, it is well that they be in a place sheltered from the prevailing winds. It will be well at the same time if the hives can be under the shade of trees. In the colder portions of the State, where it is desirable to cellar bees in the winter, a good place for summer is in the apple orchard. The shade is a good thing for both bees and bee-keeper. In hot weather it is all the better if the breezes have full sweep, but shelter from them is desirable in winter, as also in fall and spring.

BEE-STANDS.

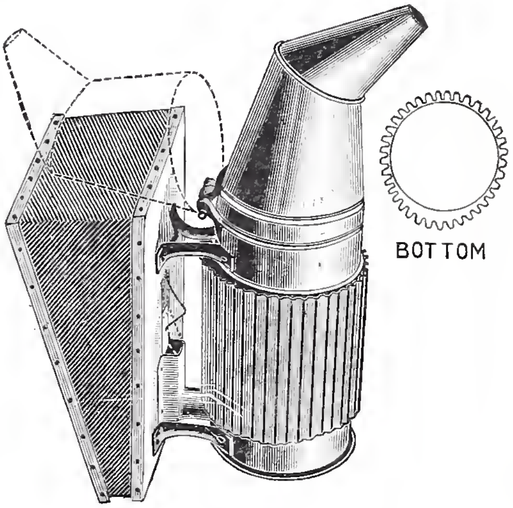
The former practice of having hives placed on benches or stands a foot or more high is no longer in vogue. In the height of the honey harvest many bees drop on the ground in the front of the hive as they return from the fields, and they must rest there for some time before they can rise and fly to the entrance of the hive. If the hive is low down, they may crawl directly into the hive without waiting. If it were not for rotting the wood, a hive might be set directly on the ground. A good stand for two hives (it is well for hives to stand in pairs) is very simply made of common fence boards. Cut two boards four inches longer than twice the width of a hive, and two as long as the length of a hive. Nail the two short boards on the ends of the two long boards, and your stand is complete. Place the stand with the long boards uppermost, and you can put on it two hives side by side with four inches space between them. Level the stand from end to end, and let the front side be a little lower than the back side.

BEE-SMOKERS.

Before beginning actual manipulation of bees, it is well to be supplied with a bee-smoker. If you are addicted to the unfortunate habit of smoking tobacco, you may blow tobacco smoke upon the bees, but such smoke is rather severe. You may also have a pan of coals with wood burning upon them and blow the smoke from this with your breath, but it is inconvenient and not very satisfactory. A Clark bellows smoker can be had for fifty cents, and it is an excellent smoker, while it lasts, but if you have much use for a smoker it will be cheaper in the long run to get one of the best, as the Crane or the Bingham of large size, costing $1.25. A Cornell, however, costing seventy-five cents, is very nearly as good.



CLARK COLD-BLAST SMOKER.



THE CRANE SMOKER.

(By permission from Root's A B C of Bee Culture.)

FUEL FOR SMOKERS.

It does not matter a great deal what fuel is used in a smoker, only so it makes a good smoke. As a starter, nothing is better than some live coals from the cook-stove. When this is not convenient, a match may be touched to shavings, cotton rags, or rotten wood. A very convenient thing is to have some rags that have been soaked in a solution of saltpeter and then dried. Perhaps no fuel is better than sound hard wood, cut in pieces one-quarter to one-half of an inch square. The only objection is the trouble of preparing. Fine chips, gathered from the chip-yard, are good. A great variety of things may be used, and one may be controlled largely by the difficulty or ease with which the various things may be obtained. Among the many things that may be mentioned are, cotton rags, corn cobs chopped fine, leaves, planer shavings, peat, greasy cotton waste that has been thrown away along the railroads, hard-wood shavings from the turning-lathe, pine needles, etc.

Whatever be the fuel used, it is important that it be very dry, even if you have to bake it in the stove-oven. If it is at all damp, the fire will not keep good without constant blowing, and inky drops will fall from the muzzle of your smoker.

ANGER OF BEES.

Do not make the mistake to think that because smoke frightens the poor little bees you will use it unmercifully. Try to avoid arousing their anger. One thing that bees pointedly resent is rough jarring of the hive or quick motions. If you open a hive slowly and gently, you may, by using slow movements, lift out frame after frame without a veil or smoke, and if the bees are Italians and honey is coming in at the time you need have little fear of a sting. Go to the hive at a time when no honey is coming in, lift the cover with a snap, and roughly lift out the frames, and the probability is that you will beat a hasty retreat, for a number of bees will make a bee-line for your hands and face and leave their stings there.

So it is wise for you to be somewhat gentle at all times in dealing with the bees. Sometimes even a quick motion of the finger in pointing at them will draw a sharp attack. While you may get along without any smoke by being careful, unless you have abundant time to spend, it may be as well to give the bees a little smoke, enough to cause them to fill themselves with honey, for when bees have a wellfilled honey-sac they are likely to be good-natured, and then you can work more rapidly.

As already intimated, bees are of a better temper when they are busy gathering stores. In the cool of the morning or evening they are not so good-natured. If there is a sudden stoppage of the harvest, and robbers are troubling, you may find them like so many little demons, and the very next day you may find them gentle as flies because the honey-flow has started up again. If not too inconvenient to do so, it is a good plan when you find them very cross to close up the hive and try it again when they are in better humor. The best time is generally in the heat of the day, the hotter the better if they are gathering.

Sometimes a lot of cross bees will follow you around, and it seems that all the bees are cross, when in reality the cross bees all come from one colony. By a little close observation you can find out which is the cross colony. It may be there is some excuse for its temper, as it may be queenless, and a strong colony that is queenless is not likely to have a sweet disposition. If, however, it is cross when others are good-natured, and there is no good excuse for it, the best thing is to kill its queen and give it one of better stock.

Do not get directly in front of a hive, thus angering the bees by interfering with their passage. Never strike at a cross bee unless you strike to kill. The quick motion of striking exasperates. If a cross bee follows you, and you cannot kill it, or do not want to, hold down your head and walk slowly away, and it will not be likely to sting you.

Remember that a bee stings only in defense of its home or its life. A bee out at work on the flowers can never be induced to sting you unless you catch it and pinch it. You may catch it and hold it in you hand all day, and it will never offer to sting until its life is threatened by your squeezing it. A bee will seldom follow you inside the door of a house, and if it should happen to get into a house, its only anxiety will be to try to get out again. If it should happen to get inside your veil, in nearly every case it recognizes that it is a prisoner, and in stead of stinging turns its whole attention to making an escape, only to renew the attack the minute it escapes.

It is some comfort to know that if you have much to do with bees and are stung often, you become to a certain extent immune to the poison. A veteran bee-keeper may wear a veil to keep the bees out of his face, but his hands will generally be bare, for he prefers the little trouble of the stings to the discomfort of gloves. An old bee-keeper will tell you, "When I first kept bees, a sting on the hand would make my hand swell up to the shoulder, and I could hardly use the hand for a day or two; now if I get half a dozen stings on one hand in the morning, by evening I cannot tell which hand was stung, only as I remember it. Just for the minute, the sting hurts as bad as ever, but it only lasts a minute, and it doesn't swell."

The kind of clothing one wears among the bees makes some difference. Anything woolen irritates them, and the touch of fur makes them furious. Fortunately, one does not need to wear furs at the time when most work is done with bees. A smooth, hard surface of linen or cotton is best. Light-colored clothing it better than black or dark.

BEE VEILS.

The novice is likely to fear stings so much as to desire to be clad in a bee-proof armor. But that is not very pleasant on a hot day. With light-colored cotton or linen clothing there is little fear of stings elsewhere than on the hands or face. The favorite point of attack seems to be the eyes. Some wear sting-proof gloves, but after some experience the inconvenience of gloves on a hot day is generally considered worse than the stings. Ladies, however, sometimes wear gloves to avoid the unpleasant feeling of having the hands daubed with bee-glue. Most bee-keepers prefer to wear a veil.

Any veil will do that will keep out the bees and at the same time not interfere with the sight. Black is the only color for a bee-veil. A light-colored veil may not only interfere with the sight, but may injure it. The thinner the stuff the better, only so it is strong enough.

A good bee-veil may be made of an open cotton material called bobbinet or cape-net. It is about twenty-one inches wide. A piece is cut off a little longer than the circumference of the brim of the hat over which it is to be worn, and both ends are sewed together. This makes a bag open at each end. A hem is made at each end and a rubber cord run through it, the cord being short enough to make a tolerably snug fit on the crown of the hat. When the veil is put on, take hold of the lower edge at the front, and draw it down quite tight, pinning it fast to the suspenders or clothing with a safety-pin. Silk tulle will make a nicer veil, but it is more expensive, and it tears more easily. It works nicely to put a face-piece of silk tulle in the veil of cheaper material.

TREATMENT OF STINGS.

When a bee stings you, in nearly every case the sting is left in the flesh and the poison sac with it. If you will quietly watch a sting thus left, you will see that it is constantly moving for a considerable time after the bee has left. While thus moving, the little muscles are accomplishing two things; one is to drive the sting further into the flesh, and the other is to pump more poison into the wound. You will readily see that the first thing to be done, then, is to get out the sting. If you take hold of it in the usual way to pull it out, you will squeeze the poison sac and squeeze more poison into the wound. Instead of that, take the thumb or finger nail and scrape out the sting.

The different things that have been lauded as cures for bee-stings count by the hundred. Perhaps nothing is better than a poultice of common mud. The experienced bee-keeper, however, does not often bother with anything as a cure, partly because he does not find that any of the cures make so very much difference, and partly because he does not want to waste time with them. He will tell you, "The very best thing to do for a sting is to get the sting out and then think of something else while you go on with your work."

SPRING WORK.

If everything has been properly done the previous season, very little work will be required by the bees in the spring. Those that have been outdoors all winter will need no attention, unless it be to have dead bees quietly scraped away from the entrance, and whatever has been done in the way of packing to keep them warm will be better undisturbed till weather is fairly warm.

Those that were wintered in the cellar must, of course, be put on their summer stands when the weather becomes sufficiently favorable, and it is not the easiest thing to decide just when that should be done. Somewhere about the time soft or red maples are in bloom will not be far out of the way. So long as the bees are quiet in the cellar, there is little danger from further confinement, and they are as well off there as to be out trying to get about in chilly weather when there is nothing for them to gather. But if they are uneasy, affected with diarrhoea, and spotting the front of the hives, it may be best to hurry matters a little. In that case they may be brought out early in March, if the case seems urgent, but never at a time when they cannot fly immediately after being taken out. If the air is still and the sun shining bright, this may be when the thermometer is at 50 degrees, but it is better to be warmer. If brought out when it is too cool, they will come out of the hives, become chilled, and many of them will never return.

Some warm days come in February or March when the thermometer in the cellar, instead of remaining at about 45 degrees, runs up to 50 degrees, or higher, and the bees become very uneasy. But a long cold spell may come after this. and it is better to persuade the bees to remain in the cellar. At such times, open at night all the doors and windows of the cellar, so the fresh cool air may freely enter. This will probably set the bees into a still worse roar, but do not be alarmed. By morning all will be quieted down, and the cellar can be again darkened.

When it comes time to take the bees out, and you are sure they can have a good flight the day they are brought out, let the cellar be opened all night the night before, so the bees will be quiet. If they are inclined to be troublesome about coming out of the hives, enough smoke may be used to keep them in until the hive is set on its stand. Some are particular to put each hive in the same place where it stood the previous fall, but most bee-keepers pay no attention to this. If a few bees remember the old place where they were in the fall, and enter the wrong hive because they have changed places, no great harm will come of it.

FEEDING IN SPRING.

In spite of the fact that bees should be disturbed in spring as little as possible, it is better for them to suffer from disturbance than from starvation. If the right amount of stores were present in the hive in the fall, there will be no need of any anxiety, and the bees may be left undisturbed. Unfortunately, it will sometimes happen, especially if the hives are small, that there may not be honey enough in the hive to last till the bees can gather from the flowers. With box-hives, you can do no better than to heft the hives and *guess*. If you guess they may run short of honey, you can put pieces of comb honey or candy under the hives, unless the hive is so arranged that it will be more convenient on top.

With movable-comb hives you can go at the matter more understandingly. With smoker alight, blow one or two light puffs of smoke into the entrance, lift off the cover, giving the bees a little smoke on top if they seem inclined to fly at you, but do not deluge the poor things with smoke unnecessarily. You wouldn't like smoke in your own eyes, and if your bees are gentle, and if your movements are gentle, very little smoke will be needed, possibly none. If you see sealed honey along the tops of the frames, you may feel sure there is no immediate danger from starvation, and it may not be necessary to lift out a single frame. If sealed honey is not to be seen, lift out one or more frames until you are satisfied as to how the case stands.

If you have been wise, you have on hand from the last season some frames of sealed honey, and one or two of these can now be given to any needy colony, putting the comb of honey close to the cluster of bees. The probability, however, is that no comb of honey is on hand. If you have no brood-comb filled with honey, it is possible that you still have some sections of comb honey that you had saved for the table. It may seem like extravagance to feed honey that may be worth possibly fifteen cents a pound, but having brought a colony through the winter, it would be very poor economy to lose several dollars by allowing it to starve now, rather than to feed twenty-five or fifty cents' worth of honey. But if you have not honey of your own, it is not wise to buy and feed honey as to whose source you are in ignorance. If you should feed honey that had come from a colony affected with foul brood, it might mean the ruin of all your bees.

In any case, you are not restricted entirely to honey for feeding. Sugar will do, if properly prepared. Indeed, after bees get to flying in the spring, almost anything they will take in the line of sweets may be fed. Maple syrup will do. All things considered, perhaps the best substitute for honey is the best granulated sugar. It may be fed in the form of candy or of syrup.

CANDY FOR BEES.

Put into a tin sauce-pan a little boiling water and set it on top of the stove, but not so that the fire can directly touch the pan. Stir into this granulated sugar—in the proportion of seven pounds of sugar to three pints of water and let it come to a boil. Let it continue to boil, dropping a little of it occasionally into cold water, and when threads of it thus dropped break off brittle, take it off. Continue to stir it, and pour into shallow pans that have been greased, so that the cakes of candy will be an inch thick or less. These cakes may be laid directly over the frames in the hive, and then covered over with cloths, or in some way so that the heat of the cluster will not escape.

Another way is to put the candy into an empty brood-frame. Put a flat board on a level table, lay a piece of paper on the board, and on this put your frame, fastening it there with two or three nails, or by tying wire around board and frame. When your candy is cooked enough, take it off the stove and keep stirring it until it becomes so thick it will barely run, and then pour it into the frame. When it is entirely cool, it may be hung in the hive just like a frame of honey.

If you have some extracted honey, you can make a candy that is preferred, and it is less trouble to make. Take a very small quantity of the honey, heat it to less than boiling, and stir the honey and powdered sugar together to make a dough. Keep adding sugar and knead the same as you would bread dough, just as long as it will take any more sugar. Let it stand a day or two, and then you can knead in some more sugar. Cakes of this an inch or so thick may be laid on the brood-frames.

SYRUP FOR FEEDING.

Have on the stove a vessel with boiling water. Into this pour slowly five pounds of granulated sugar for every quart of water. Stir as you pour it in, for burnt sugar is very bad for bees. Cook and stir till the syrup becomes clear, then take off the stove. There are several good feeders you can buy of dealers in bee supplies, but if you have none of these you can feed the syrup in combs.

Put an empty brood-comb flat in a tub or something of the sort, and pour into it from a height of four feet or so the syrup. It should fall in very fine streams, and for this purpose you may use an empty baking powder can, with its bottom punched full of nail holes. The hotter the syrup the more readily it will enter the cells, but if too hot it may melt the combs. If necessary, you can add water to thin the syrup, or you can use a larger proportion of water in the first place.

The crock-and-plate plan of feeding is less dauby and may suit you better. For this the syrup may be hot or cold, as it happens. Put the syrup into a common stone crock—a one-gallon crock is all right—cover over the crock one or two thicknesses of flannel or woolen cloth, or else five or six thicknesses of cheese-cloth, and over this put a dinner plate upside down. With one hand under the crock and the other over the plate, quickly turn the whole thing upside down, and set it on top of the brood-frames. A hive-body must now be put over and the hive-cover put on, so that no bee can get in from the outside.

It is better to do feeding in the evening, for if done earlier in the day robber-bees may be attracted.

SPRING OVERHAULING.

Having made sure that there is no danger of starvation, the bees may get on without further attention until it is time to put on surplus receptacles. Indeed, if the right care was taken in August or September, or even in October preceding, to make sure that abundant stores were in the hive, there may be no absolute need of attention from fall until summer.

With movable combs, however, it is considered worth while by many to give a kind of overhauling a little after the fashion of spring cleaning in house-work. The object is to see that all is right in every hive; that each colony has a good queen, and to make further assurance that there is no danger of starvation before the honey harvest comes.

Keep in mind that ten pounds of honey more than actually necessary will do no harm, while ten ounces too little means loss of the whole colony. You may be surprised to find how rapidly the honey in the hive will disappear after brood-rearing gets fairly under headway in spring. It is not enough that bees at such a time be given from time to time just what they will use. They seem to look ahead, and will do more at brood-rearing if they know they have ample stores to nourish all the brood they may raise. So be sure they have not only plenty, but abundance of stores.

CLEANING HIVES.

In localities where propolis or bee-glue is troublesome, some think it pays well to clean the hives each spring, for in time they become so badly glued that it is not easy to move the frames. Set the hive to be cleaned to one side, and put in its place on the stand an empty hive that is clean. Lift the frames, bees and all, out of their hive, and put them in the hive on the stand. Brush or jar out of the hive the few remaining bees, and scrape it clean of bee-glue. A common hatchet is a pretty good tool for this purpose. This cleaned hive can be used to replace the next hive, and so on.

QUEENLESS COLONIES.

At the time of the spring overhauling, see that each colony has a good laying queen. If you find no brood in the hive by the last of April (and you will hardly undertake spring overhauling before this time), you may be safe in concluding they are without a laying queen. Such a colony is generally of very little value. It is not strong in bees, and what bees it has are probably old and dying off rapidly. Knowing that a queenless colony will rear a queen for itself if it has young brood given to it, you will be very strongly tempted to try to continue the colony, but please don't give way to the temptation. The queen they raise is not likely to be a very good one, and it will be more than a month before any of her progeny will be added to the population, which will be very weak by that time. The frame of brood you give them to raise a queen from will be quite a loss to the colony from which it is taken, and you will probably lose more than you will gain by taking it. Instead of trying to have the queenless colony rear a queen, break it up, giving the frames, bees and all, to other colonies. If the bees are smoked a little when these combs with adhering bees are given to them, there will generally be no fighting.

MANY BEES VERSUS MANY COLONIES.

Right here is a good place to emphasize the point that it is more important to have many bees than to have many colonies. The beginner is very likely to put the emphasis on the number of colonies. Let us consider the case in spring, when colonies are building up. Suppose we have a colony with only bees enough to fully cover one comb. Of course, that is the only comb in the hive in which brood can be reared. Suppose this comb to be the third comb in the hive. The space between this third comb and the second comb will be filled with bees, and so will the space between the third and the fourth comb; that is, we have bees enough to fill two spaces. Now suppose we have twice as many bees, or bees enough to fill four spaces. That will fill the spaces between the first and second combs, and also the space between the fourth and fifth; so, although we have three combs covered with bees, it takes only twice as many bees as it took to cover one comb. You will now understand that if we have in a colony bees enough to cover three combs, that by dividing them into two colonies we would have more colonies but less brood, and brood is the thing we are very anxious to have, for brood is what makes bees. If you will observe in the spring, you will see that a colony with only bees enough to cover two combs of brood remains stationary until the weather becomes warm, while a colony with bees enough to cover four or more frames of brood increases in number right along.

When the weather becomes hot, a weak colony can do better at increasing, but when you compare the harvest from weak and strong colonies, even here it will be found that is desirable to have many bees rather than many colonies. If a colony with 25,000 bees stores a certain amount of surplus, one would be likely to conclude off-hand that a colony of 50,000 bees under like conditions would store twice as much. That would be an erroneous conclusion, for the colony with double the number of bees would be likely to store three times as much surplus.

One of the most common errors of beginners is to increase too rapidly in number of colonies, and one of the hardest lessons to learn is that many bees is the *desideratum* rather than many colonies. It is the strong colonies that count, either in rearing bees or storing surplus. The golden rule for bee-keepers has been said to be this: "Keep your colonies strong."

DRONE-LAYING QUEENS AND LAYING WORKERS.

You may find eggs and brood in all stages, and yet affairs may be in a desperate condition, for the brood is of such character that only drones will emerge from the cells. Nothing but blank ruin is in store for such a colony. When a queen becomes very old, and sometimes before she is very old, she may cease to lay worker eggs, laying only eggs that will produce drones. She will lay regularly in worker cells, but the outcome will be nothing but drones, smaller in size than usual because of their cramped quarters. It is not hard to distinguish a case of this kind. The first thing perhaps that attracts your attention is the unusual number of drones, but the conclusive evidence is found in the sealed brood. Worker brood, when it is sealed, presents a flat surface; but if drone brood be in the worker cells, the cappings will be raised, looking much like a lot of little marbles.

But when drone brood is found in worker cells, it is not always the case that a bad queen is present. There may be no queen at all. When a colony has been queenless for some time, a number of workers may undertake the duty of egg-laying, and such eggs will produce only drones. The cappings of the brood in worker cells will show the same raised appearance as in the case of a drone-laying queen. Even before any brood is sealed, you may tell the presence of laying workers by the way in which the eggs are laid. They are somewhat scattering, instead of having every cell regularly filled, as in the case of a good queen, and the laying workers have a preference for drone cells and queen cells. If you find drone comb filled with eggs while worker cells remain unoccupied, you may suspect laying workers. If you find two or more eggs in many of the drone cells, and especially if you find a whole lot of eggs piled into one queen cell, you may feel sure you have a case of laying workers. Often the first intimation of laying workers will be one or more eggs in a queen cell and no other eggs present.

Whether you have a drone-laying queen or laying workers, the remedy is the same; break up the colony and unite with others.

CLIPPING QUEENS.

At the time of spring overhauling is a good time to clip all queens that have whole wings. Not all bee-keepers approve of clipping queens, but a large number do. The advantage is that a swarm with a clipped queen cannot sail off to parts unknown if you do not happen to be on hand to take care of them. You may lose the clipped queen, but it is better to lose the queen than to lose both bees and queen.

There are two wings on each side. If you cut off two-thirds of the large wing on one side, the queen cannot fly. It is just as convenient to cut off both wings on one side, and it is easier to tell at a glance that such queen is clipped.

Be sure that you never clip a virgin queen. If you do she will never rear anything but drones, for she cannot fly out to meet the drones. As soon as a queen is found to be laying it is safe to clip her, for she is fertilized once for life.

A queen may be clipped with a pair of scissors or a sharp knife. In catching a queen, do not grasp her by the abdomen, which is the hind part of the body, but by the wings or thorax. The thorax is the part next the head, and is not easily crushed because it is hard, while the abdomen is soft. You need have no fear of being stung by the queen. She has a sting, but will not demean herself by stinging anything less than royalty in the shape of another queen.

HUNGER-SWARMS.

Sometimes the beginner is surprised, and perhaps delighted, to see his bees swarming in early spring. But it is not because the bees are so prosperous that they can afford to send out a swarm in orthodox fashion. It is more likely that the bees have run out of stores; and such a swarm is called a hunger-swarm. It may try to force an entrance into some other hive, only to be killed there. The remedy, of course, is, to get the bees back into their own hive, if possible, and feed them.

SPRING DWINDLING.

Sometimes, for some reason not clearly understood, bees with plenty of honey and brood in the hive dwindle away in numbers, when no apparent cause can be found for it. The weak colonies are most likely to be the ones affected by this trouble. There seems to be no help for it but to wait for warm weather, when it disappears of itself. Some have tried uniting two or more such colonies together, but the united colony does not seem to last any longer than the colonies left separate, and in too many cases death puts an end to all before warm weather comes. Sometimes a colony thus affected may swarm out, but that can do no good.

STARVED BEES.

If you find a colony with no stores left, perhaps some of the bees already dropping from starvation, no time should be lost in giving them food. Even when all the bees appear dead, if the death from starvation occurred only a short time previous to their being thus found, they may yet be saved. Take them into a warm room and sprinkle them with well-sweetened water. In a little time they may show signs of life, and lick up the diluted sweet. When combs, bees and all are warmed and stores given, they may be returned to their former place.

TRANSFERRING.

Changing bees from a common box-hive into a movable-comb hive is called transferring. Such transferring may be done at any time, but until lately the favorite time has been at the time when fruit trees are in bloom. At that time there are fewer bees and less honey in the hive, and the bees will fix up the combs better while they are doing some work at gathering.

Have ready a board a little larger than one of the frames, and half a dozen or more strings for each frame, each string long enough to reach around the frame, and tie. Turn the box-hive upside down and set it down close by, putting the new hive in its place. Of course you will give the bees a little smoke at the beginning, and a little more at any time they show fight. Set over the box-hive an empty box that is somewhere near the same size, the open part of the box down. Drum on the sides of the hive with a heavy stick in each hand. If the hive and box do not fit well together, some of the bees may start to come out of the cracks. Smoke them in and keep on drumming. In a little while the bees will make a loud buzzing, which is not a sign of anger, but a sign of capitulation. They will then run up into the box, and when nearly all have gone up, lift off the box and set it on the ground, open end still down.

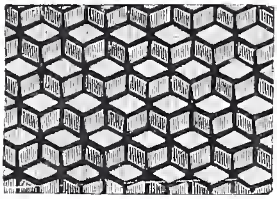
Now, with saw, hammer and chisel, as you may find necessary, split off one or more sides of the hive. Have your board ready with strings laid across it. Put the comb or combs on the board, lay a frame over, and mark with a knife where the inside of the frame comes. Take off the frame, cut off the part outside of your marking and then slip the frame over the comb. Let it be rather a tight fit, so it will be a little crowded in the frame. Now tie your strings. It doesn't matter if the combs are put in upside down. Sometimes it will be more convenient for you to put in some pieces that way. Lift up the board with the frame on it, and turn it so the frame will be right side up, and then remove the board and hang the frame in the hive. Now dump the bees down in front of the new hive and let them run in. They will be glad to find the comb there. Get out the rest of the combs and transfer all good, straight worker comb, rejecting drone comb and any that are too crooked. Some nice chunks of honey may be saved for the table. Fill up the new hive with frames filled with comb foundation. The bees will proceed to fasten the combs in the frames, and will gnaw out the strings.

You will probably find it more satisfactory to take a different plan. Wait until the colony in the box-hive swarms, when you will hive the swarm in a movable-comb hive, putting the swarm on the old stand and the old hive two or three feet from it. If the colony does not swarm by the time white clover is fairly in bloom, you may drum out the majority of the bees as already instructed, putting them in the new hive, just the same as a natural swarm. Twenty-one days after the colony swarms, or twenty-one days after the time of drumming out the swarm, drum out all the bees left in the old hive, and run them into the hive containing the swarm. At this time there will be no brood left, unless it be a little drone brood of no value, and there will be probably some honey in the hive. Set it somewhere about 100 yards from the apiary and close it up except an entrance large enough for one or two bees to pass at a time. The bees will clean out all the honey, and you can melt up the combs for wax, unless you find some nice, straight worker comb that you want to save.

If the bees do not swarm as soon as you desire, and you can obtain a frame of brood from some other colony, there is another plan that may suit you. Take from the stand the box-hive and set in its place the new hive in which you will put the frame of brood, and after filling up the hive with frames of foundation put a queen excluder over it. Drum the bees out of the box-hive and let them run into the entrance of the frame hive. Now set the box-hive over the other, closing up in some way any opening that may be between the two. Four or five days later look to see if there are eggs in the lower hive. If not, you have left the queen in the old hive, and must drum again so as to get her in the new hive. Three weeks after giving the new hive, the old hive may be removed and treated as before instructed, or you may leave it where it is till the bees have filled it with honey.

COMB FOUNDATION

Is much used in bee-keeping now-a-days. A thin sheet of beeswax is run through a foundation-mill, which embosses it in exact imitation of the base or midrib of honey-comb, as built by the bees. When this comb foundation is given to the bees, they accept it readily and built out cells upon it. This saves the bees time, labor and wax, and makes sure of having combs built just where they are desired. When used in the brood chamber, it makes sure that all the comb built upon it shall be worker-comb, a very important matter. If a strip of foundation only an inch wide be fastened to the top bar of a brood-frame, it will secure a straight comb by having the comb started in the right place, but most bee-keepers think it is



COMB FOUNDATION.

(By permission from Root's A B C of Bee Culture.)

economy to fill the frame with foundation, for if only a small strip is used there will be entirely too much drone comb built.

If a full sheet of foundation is put in a brood-frame, supported only at the top, it will very likely stretch at the upper part so as to make the cells large enough for drone cells. To avoid this stretching, tinned iron wire, No. 30, is fastened in the frames, four horizontal strands. The frames that you buy will have the holes pierced through the end bars, and you will string the wire through these holes, fastening the two ends by driving in small nails part way, winding the end of the wire around the nail two or three times, then driving home the nail. The wire should not be drawn very tight. The sheet of foundation should be cut to come within a quarter of an inch of the bottom bar. Make a board just large enough to slip inside the frame. Keep its surface wet, so the foundation will not stick to it. Lay the board flat and lay the foundation on it. Then lay the wired frame over it. Push the foundation into the saw-kerf made for it in the underside of the top bar. To press the wire into the foundation, run over it a tracing-wheel, such as the women-folks use. To make it straddle the wire, every alternate tooth should be set like the teeth of a saw. A few drops of melted beeswax along the top will hold the foundation there, unless there comes with the frame a little strip to crowd in so as to wedge the foundation in tight.

To fasten foundation in the little surplus boxes, or sections, it will pay you to buy a foundation fastener if you have much of such work to do. If you use only a few sections, you can fasten the foundation by pressing down the edge with a common case-knife. The foundation should come within one-quarter of an inch of the wood at sides and bottom. The foundation must be warm enough to be a little soft, when fastening either in brood-frames or sections, as it will naturally be on a hot summer day.

Comb foundation is made of different weights. For brood-frames that are not wired, you need "heavy brood" foundation; for wired frames, "light brood." For sections, "thin super" is generally preferred, although some prefer "extra thin." The higher the foundation, the more it costs per pound; but you get more surface in a pound, so it is cheaper.

BUYING READY-MADE HIVES, ETC.

Time was when each man's clothes were made in his own house. Now-a-days it is usual to go elsewhere to buy them. No farmer would think of making his own reaper or hoe. It is the same way in bee-keeping. The manufactories that make a business of making bee supplies can sell them for much less than you can make them for, or than you can hire them made for. Besides, they are better made. In making hives, sections, and in fact almost anything connected with bee-keeping, there is need of very great exactness, and supply manufacturers have fine machinery nicely adjusted, and, making by the hundred or thousand (some things by the hundred thousand), they can work everything to the best advantage. So you will find it the best way to buy everything ready-made, or at least ready to be nailed together. In fact, anything like hives or supers that must be nailed together would better be bought in the flat, as the freight will be less. In most cases, nails of the right kind and quantity will be sent with each order to put together the articles.

PUTTING ON SUPERS.

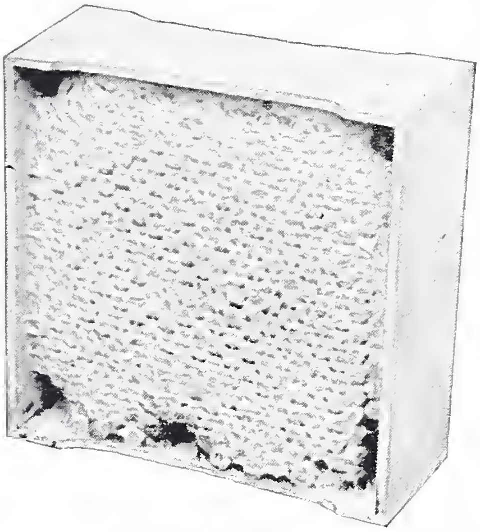
In most places in Pennsylvania, the principal harvest is from white clover and linden, or basswood. Fruit bloom, dandelions and many other things are of value, because they give the bees something to live on, fruit bloom being especially valuable because it helps to build up the colony in time for the clover harvest. Buckwheat, in some places gives a second harvest of dark honey. But it is not a sure thing that the bees can find nectar in the blossoms, even when the plants bloom abundantly. Just why, no one seems to know.

However, it is wise to be ready for the harvest, whether it comes or not. Receptacles for surplus honey should be on the hives a little before they are really needed. A common rule is to watch for the first appearance of patches of fresh white wax being plastered on the upper parts of the brood combs, and then put on supers. This will not do very well for box-hives, but you may use another guide which is all right for any kind of hives. Put on supers when you see the first white clover blossoms. The bees will hardly begin storing surplus until about ten days after the very first clover blossoms appear.

If you want to get surplus honey from a colony in a box-hive, you may make a box to cover the whole of the hive, the box being six inches deep, or you can make boxes large enough so that two or four of them will cover the hive. Have glass in one side of each box, so you can see when the box is filled, and fasten a little comb in the top as a starter. A cap or outside cover must be over all. To give the bees access to this surplus room, bore about eight one-inch holes in the top of the hive. Never mind if you do bore right into the combs and honey in the hive; the bees will patch it up all right.

SECTION HONEY.

But for movable frame hives (the only kind you will probably have after your first year of bee-keeping), you should use the little boxes that are so common, each section box containing somewhere in the neighborhood of a pound of honey. A look at the illustration shows how neat one of these sections is in appearance, and being of about the right size to put on a dish on the table, there is less daubiness than when a piece is cut from a larger comb. If you should ever have more honey than enough to supply your own table—a possibility that may be worth considering—you will find that in these sections it is in the most salable shape. A common size for a section-box is $4\frac{1}{4}$x$4\frac{1}{4}$x$1\frac{7}{8}$, but other sizes are also used, some of them of greater height than width. Supers, or receptacles for holding the sections, also vary. A full description of all the different hives, supers, sections, etc., would go much beyond the limits of this Bulletin.



A SECTION OF HONEY.
(By permission from Root's A B C of Bee Culure.)

SEPARATORS.

In order to have a comb of honey built in the right place in a section, it is necessary to have something to guide the bees, or they may build the combs crosswise. Comb foundation is used for this purpose, although a bit of nice, white honey-comb fastened in the top of the section will answer. To keep the comb within the right limits after it is started, partitions of wood or separators about one-sixteenth of an inch in thickness are used. If the honey is to be packed for shipping, most bee-keepers consider it absolutely essential that the combs or sections be built between separators. Without separators the combs will bulge into one another, one side being thick and the other thin, and when these are packed together for shipment, bruising and leaking will result. If the honey is intended entirely for home use, you can do very well without separators.

BAIT SECTIONS.

Sometimes bees are a little slow about beginning work in sections, preferring to crowd the honey into the brood-comb. If crowded sufficiently in the brood nest, they will enter the supers, but this same crowding leads to swarming, which is likely to interfere with the honey crop. The bees may be baited into the supers by having in the center of the super something more attractive to them than the bare foundation. Excellent for this purpose are the sections that were partly filled the previous year, emptied of their honey, and left over. If at first you have none of these, you may put a piece of honey-comb in a section. Still more sure to attract the bees will be a piece of comb containing brood. A section containing a piece of brood may not be so nice when finished, but it will be most effective as a bait, and you can easily afford to have a section in a super less presentable for the sake of getting the bees to begin work promptly in the supers.

But remember that unless the nectar is in the flowers, you need expect nothing in the supers. In a poor season you may have the bait section filled with honey and sealed, while every other section in the super is left untouched.

GIVING ADDITIONAL SUPERS.

Very likely your super will not contain more than twenty-four to twenty-eight pounds of honey, and in a good season this will not be enough room to suit the ambition of a strong colony. If you wait until this first super is entirely finished and ready to take off, much time will be lost, for it will take some time for the bees to finish sealing the sections after they are filled with honey.

Instead of waiting until the first super is finished, if the bees seem to be storing vigorously, give them a second super when the first is about half filled. Do no put this second super on the top of the first one, but under. If you have not a special hive tool, you may use a screw driver to pry up the first super, giving the bees a little smoke as it is raised up. Lift off the super, put the empty one on the hive, and on this the one you have taken off. No bait will be needed in this second super, for the bees will be obliged to go through it to reach the combs of honey upon which they have previously been working, and if they are in need of additional room you may be sure they will promptly begin work in the second super.

Even this second super may not be enough. Before the first super is ready to take off, three or more supers may be on the hive. So long as the bees keep busily at work, and you have reason to believe the harvest will continue, put an additional super on the hive, under the last one put on, whenever this last one is half filled. If you think the season may be near its close, and are uncertain whether to give another super or not, put it on the top of the others. It will do no harm there, and the bees will not use it if they do not need it. At best there will be some guessing in the case, for sometimes the clover harvest will close not much after the middle of June, while other years it may continue until the close of July. Sometimes the honey flow will let up as if about to close, then a few days later begin again. If linden trees are in fair numbers in your locality, you may count on their helping out the harvest during the first two weeks in July, or somewhere in that neighborhood. But, like clover, linden may vary very much in the length of its yield, and some years it does not yield at all.

TAKING OFF SURPLUS.

Comb honey is valued very much according to its appearance. To bring the highest price in the market, the comb must be snow-white. If it is left in the care of the bees after it is sealed, it will become gradually darkened on the surface. This does not hurt the honey itself that is in the comb; on the contrary the honey generally tastes better for being left in the hive all summer; and if it were to be eaten in the dark it would be well not to be in a hurry about taking it off. But to get sections off the hive with the whitest of combs, you must not even wait until all are sealed. If you wait until the sections at the outside corners are sealed, you may find that those in the center have become darkened. So soon as all but the corner sections are sealed, take off the super. If you have a number of supers taken off, you may take out the unfinished sections, put them all in an empty super, and put them back on the hive to be finished.

Taking off a super is a very simple matter; getting the bees all out is another story. If you have a Porter bee escape, put it at night under the super (the filled super to be taken off must be on top of all), and by morning very few bees will be left, when the super can be taken off. A super may be put in a tub or a big box, a sheet covered over it, and from time to time as the bees gather on the sheet, it can be turned over. Look out that you do not leave a hole for robber bees to get at the honey. A good many of the bees will leave the super and go below if you blow smoke into the super lively for two or three minutes before taking it off. If you are in a hurry to finish up the job, you may smoke all the bees out of the super after you have taken it off, brushing the bees off the super and sections as they come out. There is just a little danger that too much smoke may give a slight taste to the honey. At a time when bees are very busy gathering, you may set a super on top of a hive or beside it, and in the course of half an hour the bees will have left the super of their own accord. But it is a very risky thing to do this unless you keep a pretty close watch for the very first approach of robber bees.

BEE-BRUSH.

To brush off the bottoms of sections, a bee-brush is needed. You will also need one sometimes to get bees off brood-combs. You can shake most of the bees off a brood-comb, but the remainder must be brushed off. You can buy a bee-brush for a few cents, made like a whisk-broom of broom corn, only the corn is thin and not cut off at the ends. But if you don't care for the trouble of making one fresh every time, you can make one as good or even better out of asparagus tops, sweet clover, or any one of a number of different weeds. Get quite a bunch of it, and tie together with a string. If in a big hurry, you may grab up a big handful of long grass or weeds without any tying together. Of course, green brushes are good only for the day.

EXTRACTED HONEY.

In former days, besides comb-honey in irregular and dauby chunks, there was strained honey, secured by putting in a cloth a lot of crushed honey combs, pollen, brood and dead bees. When the honey was strained out of this, of course it was more or less flavored with the other materials. Now-a-days liquid honey, or honey out of the comb, is altogether different, being the pure honey with no extraneous flavor, just like the honey that drains out of a nice section of honey when it is cut and lying on a plate. This honey is not strained but extracted. It is thrown out of the comb by centrifulgal force, and the comb is left unbroken, so that it can be returned to the bees to be filled over and over.

As the bees have no comb to build, they can store the honey without hindrance, no matter how fast it comes. So the yield of extracted honey is greater than that of comb honey. The greater proportion of extracted over comb honey is variously estimated. Some say they can get sometimes nearly twice as much extracted honey as comb; others say they can get only a little more.

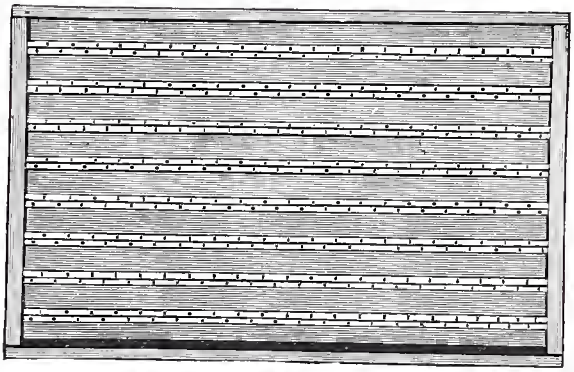
Aside from the greater yield of honey, there are some advantages in working for extracted rather than comb honey. It takes less skill to work for extracted. With a large hive and plenty of room there is less danger of swarming, when working for extracted honey. Sometimes, when the flow is short, the bees have not time to finish up any of their sections, and it is but little satisfaction to have a set of sections half filled. Even with the most skilful management there will be more or less unfinished sections. With extracted honey, it is different. No matter how little honey may be in the extracting combs, it can be thrown out.

Just on that account there is a danger. When honey, or nectar rather, is first gathered, it is thin, watery stuff, unfit for table use.

After being left in the hive it becomes ripened and rich. Some think it not advisable to extract till the honey is all sealed. At least a large proportion of it should be sealed.

EXTRACTING SUPERS.

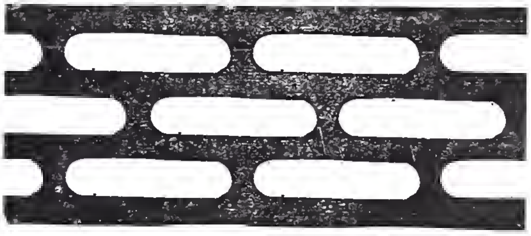
Honey may be extracted from the brood-combs taken from the brood-chamber, and if care is taken not to turn too rapidly, the honey will be thrown out and the brood left in the cells. But it is better to leave the brood-combs undisturbed, and have a separate story or stories for extracting. These stories or extracting supers may contain combs shallower than those used in the brood-chamber, such shallow extracting combs being preferred by those that produce on a large scale, but being more convenient, it is a common practice to use extracting combs that are exactly the same as the brood-combs; indeed, the same combs are used sometimes in the brood-chamber and sometimes in the extracting-chamber. Some think that honey extracted from old black combs that have been used for years for brood-rearing is not so light-colored as that extracted from combs in which brood has never been reared. But there can be no very great difference.



ZINC HONEY-BOARD
(By permission from Root's A B C of Bee Culture.)

In order to prevent the queen from going up into the extracting super, a zinc honey-board is used, called also a queen-excluder. This queen-excluder may be made entirely of zinc, but is usually made of alternate strips of wood and zinc.

The zinc is perforated with holes about one-sixth of an inch in diameter, the best size being considered 165-1000 of an inch. Perforations of this size bar the passage of a queen, while they allow workers to pass freely. The use of a queen-excluder makes it certain that there will be no brood in the extract super. Neither need there be any fear lest the queen be lifted out when combs are taken for extracting.



PERFORATED ZINC.
(By permission from Root's A B C of Bee Culture.)

It may be remarked in passing that while it is considered very important to have a queen-excluder under an extracting-super, it is not considered necessary to have one under a super for comb-honey. If the sections contain full sheets of foundation, the queen will very rarely go up to deposit eggs in them.

Some say they can dispense with excluders under extracting-supers by having very thick extracting combs. In the brood-chamber the frames are spaced about one and three-eighths inches from center to center, and this same spacing is generally used in the extracting-chamber. If, however, a smaller number of combs be used in the extracting-super, and they are spaced one and five-eighths inches or more from center to center, the cells will be too deep to rear brood in, and the queen will not lay in them.

EXTRACTING HONEY.

A honey extractor, costing somewhere in the neighborhood of ten dollars, is a machine so constructed that the combs filled with honey may be put into the comb baskets, when they are whirled rapidly around in the tin cylinder, and the rapid motion causes the honey to fly out of the cells by centrifugal force, on the same principle that mud is thrown from the wheels of a vehicle when the wheels are in rapid motion.

Do not extract from a comb until it is sealed, or at least three-fourths sealed. Otherwise you will have thin, watery stuff, and in a little while your folks will say they do not care for honey. Unless you have had considerable experience, you will do well not to do any extracting except when the bees are busy gathering. They will then be good natured, and not inclined to sting or rob.

Give a little smoke, take out the comb to be extracted, shake off most of the bees and brush off the remainder, putting the comb into an empty super brought for the purpose. You can take the combs from each hive, empty the honey out of them, then put the combs back into the same super; but if you have several colonies it will be more convenient to operate differently. After extracting the first set of combs, take them to the second colony and exchange them for the full combs of the second colony, thus replacing each full set removed with the set you have just extracted. When the last set is extracted, it may be returned to the first colony.

Before putting the combs in the extractor the cappings must be shaved off, and for this purpose you need an uncapping-knife, made specially for the purpose, although you may use a common table-knife after a fashion. Some think it advisable to have a dish of hot water in which to warm the uncapping-knife, but with a sharp knife it is hardly necessary.

Some nice honey may be drained from the cappings through a colander. Then the cappings may be given to the bees to clean up (look out you don't start robbing), or water may be added and the liquid added to the vinegar.

When combs are new and tender, and heavily filled with honey, there is danger that they may be broken if turned too rapidly in the extractor. A good plan is to turn rather slowly until about one-half the honey is extracted from one side of the combs, then reverse and extract all from the second side, when the remainder may be extracted from the first side.

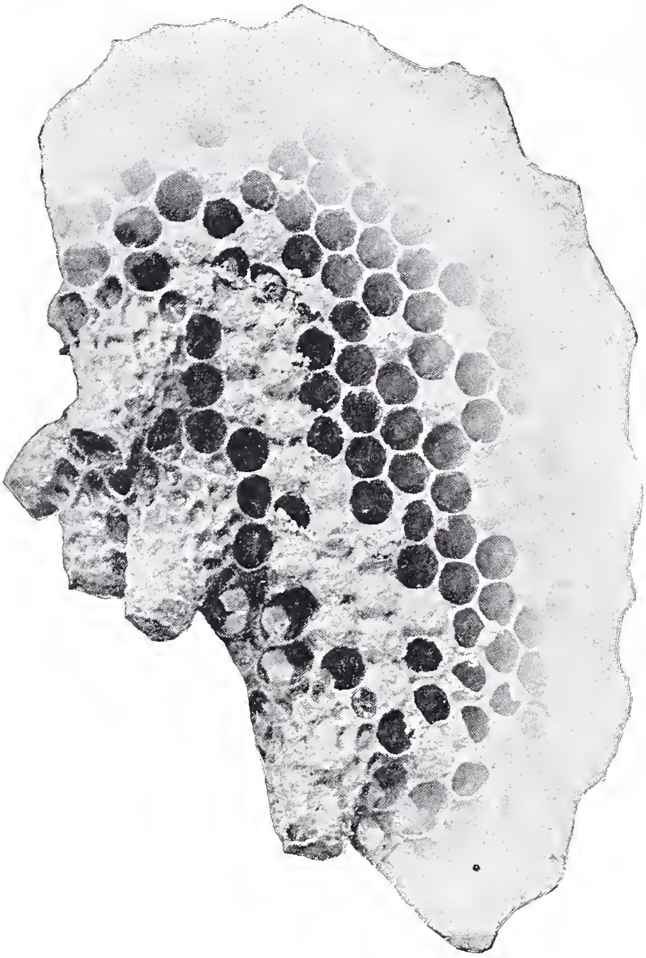
SWARMING.

If the only thing to be done through the summer was to put on empty receptacles for the surplus honey, and then to take them off when filled, it would be pretty clear sailing. But just when prospects look most favorable for a good harvest, and bees are storing most rapidly, there is likely to be a sudden change in the program. The colony swarms, and the force left in the old hive is so weak that under ordinary circumstances nothing more is done in the supers. The swarm, if very strong, may do some good work in supers, but if the remainder of the season is not very good it may do no more than fill up its hive ready for winter. In any case the swarm and the mother colony together are not likely to yield as much surplus as the latter would have done alone had there been no swarming. An exception to this rule might occur in a locality where there was a large yield from buckwheat and other late honey-plants.

Left to its own devices, a strong colony is likely to swarm twice each season, sometimes three, four or more times. The first swarm, called also prime swarm, is likely to issue during the first part of June, when the white clover harvest is fairly begun, some swarms continuing to come later, and in rare cases a swarm may issue as early as fruit bloom. A first swarm may also occur during the fall flow, generally called a buckwheat swarm, but such swarms are not common. The old queen comes out with the first swarm, leaving no queen in the hive, but it is a mistake to speak of the queen leading out the swarm, for she does not generally leave the hive until a large portion of the swarm is out, and she may be among the very last. A swarm contains bees of all ages from the oldest to the youngest.

There is no certain way to tell beforehand when a prime swarm will issue without examining the brood-combs. Even then you may not be certain, but if you find a number of queen-cells, you may expect a swarm to issue when the first of them is sealed. It is easy to distinguish a queen-cell, as you will see by the illustration.

It is easier to foretell the issuing of after-swarms. About eight days after the first swarm issues, you may expect a second swarm, providing there are to be any after-swarms. Go to the hive the evening before the day you are expecting an after-swarm, put your ear against the hive, and if there is to be further swarming the next day you will hear piping and quahking. The young queen that is out of her cell utters a shrill succession of sounds, that sound something like "peep, peep, peep." The young queens yet in their cells answer very promptly, "quahk, quahk, quahk," in a coarser tone, and this piping and quahking is repeated at intervals.


QUEEN CELLS.
(By permission from Root's A B C of Bee Culture.)

If there is any swarming after the second swarm, the swarms will be only a day or two apart. These later swarms are likely to be very feeble affairs, sometimes hardly more than a teacupful of bees with the young queen. Such weaklings are only a nuisance, as it is hardly possible for them to survive the following winter.

HIVING A SWARM.

When a swarm issues from the hive and begins to sail aloft, there is sometimes a fear that it will immediately take its departure, and horns are blown, tin pans rattled, guns fired, etc., and then the swarm settles on some bush or tree. But it would settle just as well without any such racket. It is just possible that an after-swarm might go off without clustering first on some tree, but you need have no anxiety about a first swarm. Just let it take its time to settle; then you can proceed deliberately to house it in the hive prepared for it. You may cut off the small branch upon which it is clustered, providing the value of the tree does not forbid, and it is not difficult of accomplishment; then carry the swarm to its intended hive, lay the cluster down directly in front of the entrance and close against it, and the bees will immediately begin to crawl in. If the tree is very high, the limb may be sawed off and let down by a rope.

Sometimes it is more convenient to jar down the swarm and let it fall directly in front of the entrance of the hive, the hive being placed in the proper position for the purpose. Let the hive be well raised in front so that there will be an abundant entrance. As soon as nearly all the bees are in the hive, so that you feel confident the queen is there, carry the hive to the stand you intend it to occupy.

It is the practice of some to use a peach basket on the end of a pole in which to catch the swarm. Hold the basket under the swarm, and with another pole jar the limb so the swarm will fall into the basket.

When a swarm is shaken from a limb, it is often the case that the bees will begin to cluster back on the limb again. To prevent this the limb should be constantly shaken in so lively a manner that the bees cannot settle upon it. This is tiresome work, and one way to make it easier is to have a rope. Tie a stone to the end of the rope, throw the stone over the limb, then let the stone slide down, and, holding both ends of the rope, shake.

SWARMS WITH CLIPPED QUEENS.

These must be treated differently. When the swarm issues, the queen, not being able to fly, falls to the ground. The swarm will sail around in the air and perhaps go back to the hive without settling, having recognized the absence of the queen. At other times it will settle, and may remain so a few minutes, sometimes even half on hour. If no one is on hand, the queen is likely to find her way back to the hive, and the swarm will also return, probably coming out again the next day. (If the queen were not clipped, no one being by, the swarm would probably leave for parts unknown.)

When the queen comes out, catch her and put her in a cage. The Miller introducing cage is very convenient for the purpose, but you can make a simpler one that will answer very well. Take a pine block 5x1x½ inches, and wrap around it a piece of wire cloth, four inches square. The wire cloth is allowed to project at one end of the block one-half inch. The four sides of this projecting end are bent down upon the end of the stick and hammered down tight into place. A piece of fine wire about ten inches long is wrapped around the wire cloth, about an inch from the open end, which will be near the middle of the stick, and the ends of the wire twisted together. Then pull out the block, trim off the corners of the end a little so that it will easily enter the cage, slide the stick in and out of the cage a number of times so that it will work easily, and the thing is complete. When not in use the block is pushed clear in, so as to preserve the shape of the cage.

Remove the old hive and put the new hive on the old stand. Lay the caged queen at the entrance of the new hive. When the swarm returns and a large part or all of it has entered the hive, let the queen out of the cage and let her run in with the rest. The swarm can now be moved to a new stand and the old hive returned to its place. The better way, however, is to leave the swarm on the old stand, as given under the head of prevention of after-swarms.

DESERTION OF SWARMS.

It is not an uncommon occurrence with the inexperienced to have a swarm leave a hive the next day after being hived, and if returned to the hive to repeat the process. If unobserved, and the wings of the queen are not clipped, it will leave for the woods. In the belief that it will prevent the desertion of the bees, some wash the inside of the hive with sweetened water, or rub it with leaves or something else to give it a certain odor. Nothing of the kind is needed. If a hive is not absolutely filthy, the bees will be satisfied with it if other conditions are right. In the great majority of cases the bees desert because of too great heat in the hive, or wha is much the same thing, because there is too little ventilation. Shade the hive and give abundance of ventilation, and there is likely to be no desertion. Block up the hive so the entrance shall be two or three inches deep, and let the cover be partly off for two or three days. If there is no other way to shade the hive, take a good armful of fresh-cut hay, the longer the grass the better, lay it on the hive and put on it two or three sticks of fire-wood.

If you have movable-frame hives, you can give to the swarm a frame of brood, and with such a start in housekeeping it is not likely to desert, even if the hive be not the most comfortable.

PREVENTION OF SWARMS.

The prevention of a first swarm is not always an easy matter, if, indeed, it can be prevented at all. Being crowded for room is one of the things that perhaps more than anything else encourages swarming, so plenty of room does no little towards discouraging swarming. With hives containing ten or more Langstroth frames (a Langstroth frame is $17\frac{5}{8}$x$9\frac{1}{8}$ inches, outside measure) worked for extracted honey, and with plenty of room always in the surplus chamber, the hives kept comfortable by the shade of trees or its equivalent, and with abundant ventilation, the amount of swarming will be at its minimum, some having no more than four or five colonies swarm out of a hundred. When hot weather comes, it is a good plan to put a block under each corner of the hive so as to raise it something like an inch.

The same means will do something toward preventing swarms when working for comb honey, but the number of swarms will be much larger.

The prevention of a second swarm is a more easy matter, and with proper care you may count pretty safely on preventing all swarms after the first. In order to understand fully the matter, it is necessary to explain a little about the habits of bees. On a summer day, if you will watch a colony of bees, you will see at some time during the heat of the day a large number of bees flying in front of the hive. They are flying about in circles, keeping close to the hive. They are young bees, some of them taking their first flight, and are out for a play-spell. Each bee, as it leaves the hive, turns its head toward the entrance, circling about with its head always toward the hive, circling farther and farther from the hive all the time, apparently noting carefully the hive and its surroundings. It is marking the location of the hive. When about sixteen days old it becomes a field hand, and then it acts quite differently. It wastes no time when leaving the hive, but shoots out in a straight line for the fields, and on its return comes back on the same bee-line directly to the location it has previously so carefully marked. If, while it is out in the field, you take away its hive and put another in its place, it does not look for its hive, but goes straight for its old place. More than this, if you take a hive from its stand and put another in its place, all the field bees of the removed hive, when they start to the field, will shoot straight out without noticing any change, and when they come back will go straight to the old location, even if they do not leave the hive for a day of two after the change has been made.

Another thing. Bees seem to know that if the honey harvest stops, they can hardly afford to swarm; and even after cells are started, if the yield ceases, they will tear down the cells and give up the idea of swarming.

Understanding these habits of bees, we may take advantage of it to prevent all swarming after the first swarm. When the first swarm issues, put the swarm in the place of the old hive, setting the old hive close beside it, both facing the same way. A week later take away the old hive and set it in a new place a rod or so distant. If other hives are sitting near, it is not necessary to move it farther than beyond the nearest hive. During the week since the swarming, a great many young bees have hatched out in the old hive, and it has begun to feel quite strong. But after the removal all the field bees will desert it and join the swarm on the old stand. This weakening of the colony will greatly discourage the thought of swarming, and the discouragement will be increased by the fact that for that colony the harvest has ceased, for little or nothing is brought in from the field. So all the young queens but one will be destroyed and there will be no further swarming.

If supers were on the colony when it swarmed, they should be given to the swarm about two days after swarming. If put on immediately after the swarm is hived, there is some danger that the queen might go up and lay in the sections, but after a day or two she will have a brood-nest started below and will have no desire to go above. If extracting combs are in the super, then the super may be given as soon as the swarm is hived, as a queen-excluder will prevent the queen's going above.

CARE OF COMB HONEY.

It is by no means a matter of indifference as to how honey is kept, Especially important is the place. A common practice with those who know no better is to put it in the cellar. Before long the beautiful white sections begin to have a darker appearance; later on, small drops of sweetish water oozes out through the cappings, increasing in size until they run down in streaks over the surface. When the comb is cut open, the honey is found to be thin and watery, and in course of time it sours. Then the good woman of the house wonders what can be the matter with the honey.

She should know that honey has a strong affinity for moisture. The air of the cellar is moist, and that moisture is attracted by the honey. That's the whole trouble. Instead of putting the honey in a moist place, put it in the driest place. Wherever salt will not keep dry is not a good place for honey. In the kitchen cupboard is a good place; the higher up the better, because warmer. If you are fortunate enough to have an attic, where there is no covering overhead but the roof, and where, in the hot days of summer, it is so hot and close that you can hardly breathe, that's an ideal place to keep comb honey except in freezing weather. It will even stand the freezing of winter if it has stood in such a hot place during a considerable part of the summer. A hot and dry place is what is wanted.

Unless comb honey has had an extra chance to ripen, as in a hot garret, through a good many summer days, the effect of severe freezing is to make the comb crack across the surface. So it is desirable that in winter time comb honey shall not be subjected for a long time to severe cold.

CARE OF EXTRACTED HONEY.

It is easier to keep extracted honey in good condition than comb honey. If one goes to the trouble of heating it and sealing it up as fruit is put up, it may be kept for years, and may be kept in any place, dry or damp. But it will not do to heat it as hot as fruit is heated when fruit is canned. That would ruin it. Let it be fairly understood that the flavor of honey is a very delicate affair, and will be changed or destroyed by being heated beyond 140 to 160 degrees. The color also will be darkened by too much heat.

It is not necessary, however, to seal up extracted honey. It may be kept in stone or glass, or even tin, and if simply covered over it will keep all right unless it be in a damp place. In a damp place, it will attract moisture the same as comb honey, and in time will become thin and sour; but if it is well covered up the change will take place more slowly than with comb honey.

CANDIED OR GRANULATED HONEY.

There is one change, however, that is likely to take place with honey, whether comb or extracted. After a time, as cold weather advances, it changes from its clear liquid form and becomes granulated or candied. Some prefer it in this form, and, perhaps, more would if they became accustomed to it. Some of it can be made quite dry like candy. Turn a crock of it upside down, and let the liquid part drain off for a few days, and what is left will be dry like sugar, and can be done up in a paper package.

Most persons, however, prefer it in the liquid state. Fortunately, it can be restored to the liquid state without injury, if sufficient care is taken. Put it on a hot stove and let it boil, and it will be liquid—but ruined. It must not be allowed to get very hot. Give it *time enough*, and it will become liquid without being kept very hot. All the better if it takes three days or more. One of the best ways is to put the crock of granulated honey on top of the reservoir of the cook-stove, and leave it there enough days to have all the granules melt. If you are in too much of a hurry to wait for that, take another plan. Set the crock of honey in a kettle of water, and let the kettle stand on the back of the stove so it will never boil. Of course, a pan will do in place of a kettle if more convenient. It will not do for the crock of honey to stand directly on the bottom of the kettle, for in that case it might be overheated. Let a piece of shingle or something of the kind be in the kettle for the crock to stand upon.

After a time the honey will become candied again, when it must again be liquefied in the same manner.

Cold hastens granulation; so does stirring. If liquid honey be put in a dish that contains even a very little granulated honey, it will hasten the granulation of the whole.

Comb honey does not granulate so readily as extracted, but it is likely to begin granulating by the time it is a year old, especially if it has suffered from hard freezing. If it has been kept in a hot garret through the summer it may stand a good deal of freezing without harm. There is no way to bring candied comb honey back to the liquid form and still have it in the comb. It should be melted slowly without being overheated, as already described for candied extracted honey. Then when it has become cold, lift off the cake of beeswax, and you have a nice article of liquid honey for the table, unless it has become soured as well as candied.

TREATMENT OF SOURED HONEY.

The question may arise, what shall be done with honey, either in the comb or extracted, which has become thin or sour? In some cases it will be greatly improved by allowing it to stand a sufficient number of days on the reservoir of the cook-stove to get the benefit of the mild heat. Sometimes a crock of granulated extracted honey that seems quite bad may be made good. The surface is about as thin as water and somewhat soured, but farther down it is solid grains. Turn the crock upside down or on its side over another crock, and give it two days or more to drain off. Then melt slowly the solid part left, and there will be no sourness about it. Of course, there will be no need to melt it for those who prefer it candied, but the thin part must be drained off.

HONEY VINEGAR.

But even if the honey is so thin and sour that there is no possibility of making it fit for table use, there is no need of its being wasted. It can be used for vinegar, and it is a fact that the very finest of vinegar can be made from honey. When the thin, sour part is drained off candied honey, it can be thrown into the vinegar barrel. When honey is extracted, there will always be more or less honey in the cappings, and after there is saved for the table what will easily drain off, there will be still some left adhering to the cappings. A little water may be added to the cappings and thoroughly stirred up with them, and then drained off to be added to the vinegar. This draining will be more complete if it is done in a cellar.

Besides using such odds and ends for making vinegar, some think it profitable to use good honey for the purpose. It is said to keep pickles longer than other vinegar. Make water sweet enough with honey so that when a fresh egg is put into it the egg will float, leaving above the liquid a spot about as big as a silver dime. Then treat as all good housewives know how, by keeping it where the sun can shine on it or in a warm place, with a chance for the air to get to it freely without a chance for flies to get in.

IMPROVEMENT OF STOCK.

Every farmer knows that there is a great difference in his cows, hens, etc., but there is too often a feeling that all bees are alike, and that bee-keeping is all a matter of luck anyway. If you observe closely, you will find that one colony of bees may give you good returns, while another sitting beside it does nothing in the surplus chamber. Bees are by no means all alike. They differ in disposition, temper, industry, and in other ways. It is worth while for you to have the best. Fortunately the change from poor to good stock may be made more rapidly than with other kinds of stock, and at less expense. By paying out a dollar or two for a queen, you may change a colony of poorest black bees to Italians. All you need to do is to send off your order to a reliable queen-breeder, such as advertise in our agricultural papers, and the queen will come by mail, with directions for introducing which you can easily follow. As a worker-bee only lives about six weeks in the busy season, and as the new queen will be laying from one to three thousand eggs in a day, you will see that if you get an Italian queen into a colony it will not be a great while until all the bees in the hive are Italian.

Even if you do not change from one kind of bees to another, it is generally a matter of advantage to introduce fresh blood occasionally. In any case, whether you get fresh stock from outside or not, whether your bees are Italians, blacks or hybrids, there is always something to be done in the way of improving your stock, so long as any one of your colonies is better than any other.

ITALIANIZING.

The probability is that you will want Italian bees, if your bees are not already Italian. The greater industry of Italian bees, and the greater amount of honey they will store in the course of the season, together with the fact that with Italian bees you need have little fear of wax-worms or moths in the hive, are sufficient reasons for preferring them.

For two dollars or so you can buy a *tested* queen. That means a queen reared from an Italian mother, the young queen having been kept until young workers have hatched out from her eggs, and they show by the three yellow bands that the queen has mated with an Italian drone. If such a queen mates with a black drone, the worker progeny may have one or two yellow bands, or they may be mixed, some of them with three bands and some with none. When you have a queen from an Italian mother, the young queen having mated with a black drone, you have what are called hybrid bees, although it would be more correct to call them a cross. So, if you buy a tested queen, you will know that all the workers, drones and queens reared from her are Italians.

Perhaps you may prefer to buy an *untested* queen. She is reared from an Italian mother, and has begun to lay, but none of her progeny have yet hatched out, so it can not be told whether she has mated with an Italian or a black drone. The chances, however, are largely in favor, in most cases, of her being purely mated. In consideration of the fact that the breeder sends her out about three weeks earlier than if he had waited for her to be tested, he will charge you only a dollar or less for her. If it turns out that her worker progeny show the three yellow bands, then you are just as well off as if you had bought a tested queen, for your untested queen has now become a tested queen. It may be well to mention that the first of the yellow bands, the one nearest the head, is very small, and if you do not look closely you may not notice it, especially if the worker is not filled with honey.

In one respect the eggs of bees are different from the eggs of hens. If a white Brahma hen is crossed with a Langshan rooster, all the progeny, male and female, will be cross-bred. If an Italian queen is mated with a black drone, all the queens and workers raised from that queen will be cross-bred (hybrids they are called,) but the drones will be the same as the mother. In other words, the mating of the queen has nothing to do with kind of drones she produces. The explanation lies in the fact that each egg laid in a worker-cell or a queen-cell is fertilized by the queen at the time the egg is laid, but eggs laid in drone cells are not fertilized. It may happen on rare occasions that an egg laid in a worker-cell may not be fertilized, and that egg will produce a drone, and it is also possible that a fertilized egg may be laid in a drone cell, and from it a worker will issue, but with a normal queen such exceptions are very rare. The eggs of a laying worker, or of a queen that has begun laying without ever having mated, or of a queen so old that she has exhausted her store of fertilizing material, will produce drones, and drones only.

So it happens that if you get an Italian queen that has mated with a black drone, giving you workers that are half-blood Italian, you *may*, in the next generation, have workers that are three-fourths

Italian blood. For the queens you rear from that queen will be half-blood, and the drones full-blood; so, if one of those queens mates with one of the drones, the resulting worker progeny will be three-fourths Italian. Having one Italian colony in the apiary, it is only a matter of time to get more or less Italian blood into your other colonies. But so long as your neighbors within two or three miles of you have black bees, you will find a constant tendency to work back toward black blood.

CONTROL OF FERTILIZATION.

It is a rather discouraging circumstance that anything like absolute control of fertilization has never yet been reached. The queen flies out of the hive to meet the drone high up in the air; and she may meet a drone from one of your own hives, but is more likely to meet one from some hive half a mile away, possibly three or four miles away.

Perhaps the nearest toward control has been something like this: Into the nucleus containing your virgin queen put the desired drones and put the nucleus in the cellar, the queen being at this time about four days old. Two days later, after drones have ceased flying, say four o'clock, bring out the nucleus and give it some diluted honey or sugar syrup. This will stir up the bees to fly, and there will be a prospect that the queen and drones will also fly. This is more trouble, perhaps, than you are willing to take, especially as you have nothing entirely sure.

But you may and ought to do something in another way, especially if you have quite a number of colonies. Decide which are your best colonies; from the very best one rear your queens, and allow the remainder of the best to have some drone comb, and keep all drone comb out of the other colonies. Then you will know that none but the best drones from your own apiary will be used, but must stand the chance of what your neighbors have, unless you can prevail upon them to co-operate with you.

KEEP RECORD OF YOUR BEST COLONIES.

How are you to know which are your best colonies? By keeping track of their performance, and putting it down in black and white. It is some trouble but it will pay you well. It is the belief of some that the right way is to measure the tongues of bees, and count those best which have longest tongues. The average length of a bee's tongue is perhaps not far from 13-100 to 15-100 of an inch; not long enough to reach the bottom of a red clover blossom. But some tongues have been found as long as 25-100, and if we could have all our bees with such tongues we might get the many tons of red-clover honey that now go to waste.

Whether you do any measuring of tongues or not, you can keep account of the amount of surplus honey you take from each colony, and set it down at the time of taking from the hive, at least the approximate amount. The next year you can select the best for your queen-breeder, and a certain number of the next best for drone rearing. One thing, however, must be taken into consideration, and that is whether there has been no change of queens in any of these colonies. The colony that gave you the largest amount of surplus last year may have superseded its queen last fall or this spring, and the young queen may have met a drone of poor stock, and from this you do not wish to breed. You can count only on those colonies that have made a good record and still have the same queen with which they began the season last year. You must also take into account any special advantages or disadvantages. If from colony No. 1 you took two frames of brood in the spring to give to No. 2, and you then found that No. 2 stored just a little more surplus than No. 1, it would not be fair to rate No. 2 as better than No. 1. The matter of swarming also comes in. A colony that has cast no swarm throughout the season ought to be expected to store more surplus than either the swarm or the mother colony that has swarmed—generally more than both together. Nearly always, however, it will be found that the bees that do the most work are the least given to swarming; so the swarming of a colony counts against it in making out its character.

In the ordinary course of management, where bees are left to their own way, and all the increase is through natural swarming, there will, of course, be the most increase from the colonies most given to swarming, which means that the general character of the apiary will run toward swarming rather than storing.

AN EASY WAY TO IMPROVE STOCK.

We want, however, to have the tendency the other way. There is a way in which a good deal can be done in the way of improvement, even by those most unskilled in the management of bees, whether the bees are in movable-frame hives or box hives. Having decided which one or two or three are the best colonies you have, watch for the first one that swarms. Suppose Nos. 1, 2 and 3 are your best, and that No. 4 is the strongest of the rest, and the rest follow in the order of their strength, 5, 6, etc. Suppose No. 2 swarms. Hive the swarm and put it on the stand of No. 2. At the same time put No. 2 in place of No. 4, and put No. 4 in a new place. All the field bees that were in No. 2 will join the swarm, making it good for work. No. 2 will thus be deprived of its field bees, but on the other hand it will get all the field bees that belonged to No. 4. In about eight days No. 2 will have a young queen matured, and will send out a swarm. You will now proceed much as you did before. Hive the swarm and put it in the place of No. 2, and put No. 2 in the place of No. 5, putting No. 5 in a new place. The field bees of No. 5 will strengthen No. 2, and in a day or two it will send out another swarm. Proceed as before, putting No. 2 in place of No. 6, and so on as long as swarms issue. In this way you have, perhaps, no swarms from 4, 5, etc., but in their place you have swarms from No. 2, all of them having queens of your best stock. When No. 1 swarms, or No. 2, you can treat them the same way.

There is, of course, the possibility that No. 1 or No. 2 may not be accommodating enough to be among the first to swarm. With box hives you cannot do much to control this, unless it be by feeding the one you desire to swarm, but with movable-frame hives you may do much. Take frames of sealed brood from colonies that you do not want to swarm, and give to one of your best colonies, and you can thus strengthen it so as to hasten its swarming, while delaying the swarming of those from which the brood was taken. Of course, when you take these frames of sealed brood, you will merely exchange them for frames that have little or no sealed brood in them.

QUEEN-REARING.

Rearing queens has become quite a trade, and some bee-keepers make a business of shipping queens by mail to those who wish to purchase. Indeed, so important is the matter of queen-rearing, and so much of a science has it become, that an excellent book has been written which is devoted to that subject, "Doolittle on Queen-Rearing." Although it may not be desirable for the farmer with only a few colonies to go into the subject fully, he should know enough about it to rear queens at times for his own accommodation.

When a colony prepares for swarming, a number of queen-cells are started, eight, ten, possibly many more. As soon as the first one of these is sealed, the colony is likely to throw off a prime swarm. Six or seven days after this swarm has issued, the mother colony may be divided up into two or more parts, each part being called a nucleus, the word "nucleus" merely meaning a very small colony. (See the subject of nucleus farther on.)

Perhaps you will generally have enough queen-cells in each nucleus without any attention, but not always. Sometimes you will find a large number of queen-cells on one comb, and some combs without any. So it might happen that if you give the matter no attention you might have a nucleus without any queen-cell. Another thing must be considered. A large proportion of the queen-cells are built on the lower or outer edges of the combs. If these were left in the old colony without dividing, they might be all right. But when these combs are put in nuclei, it is harder for the smaller number of bees to keep them warm, and when a cool night comes, the bees will shrink away from the edges of the combs, and the queen-cells will be chilled. Hence, you must see that each nucleus has at least two or three good queen-cells where they will be sure to be inside of the cluster of bees in the coolest nights.

So you will cut away cells from the edges of the combs and from combs that have them to spare, and fasten them where desired. To cut out the cells, you may use a pocket knife with a sharp, thin blade that is more than an inch long. You need not cut away more than enough to get all the cell; but be sure you do not cut into the cell. Be sure you do not let one of the cells fall, for, while the young and tender queen is in the cell, a fall may cause a defective wing or leg. A defective leg would not necessarily destroy the usefulness of a queen, but a young queen with a wing so poor that she cannot fly is utterly worthless, for she must be able to fly until after she has made her wedding trip.

To fasten a queen-cell where you want it, use a long pin, or a slender wire nail an inch and a fourth or an inch and a half long. Push the nail through the base of the cell, but be sure it does not enter the cavity of the cell. Nail the cell right over some of the brood, for it will be more surely taken care of there than if separate from the brood. You will find that the bees build queen-cells with the point hanging downward, but it is not important that you should have them in exactly the same position. A cell will do just as well if lying on its side, and possibly as well if upside down. Still better than a nail to pin on a cell, is a staple such as a tobacco staple, the staple being an inch or more wide, with legs an inch long, although legs three-fourths of an inch long will answer. Lay the cell against the comb, put the staple over it so the cell will be at one side of the staple, and then sink into the comb the staple point that is farthest from the cell.

Possibly you may be inclined to think that because only one queen is to be reared in a nucleus, there is no need to have more than one queen-cell. That would be a mistake. While most of the cells reared by a colony preparing to swarm may be of the very best that colony can rear, it is not safe to assume that all are equally good. Some cells may contain poor queens, and some cells may contain nothing but a dead larva. So it is wise to have a number of cells in a nucleus—at least two or three. The bees will be likely to use the best. You will be able to see a difference in the appearance of the cells, and while you are dividing the cells among the nuclei, you may as well see that each nucleus has its fair share of the best-looking cells. The best cells are generally among the largest and longest, and are deeply pitted over the surface. A stubby cell that is not pitted but has a smooth surface is not so likely to be good.

When the young queen is five to eight days old, she will fly out on her wedding trip, and about three days later she will begin laying. It may be well not to look for eggs till the queen is perhaps two weeks old, for at first the eggs are few and not so easily found. If you do not find eggs when the queen is two weeks old, you are not likely to find any later—the queen has been lost on her wedding trip or there is some other trouble. There have been cases where a queen did not lay until more than three weeks old, but such queens are not generally very good.

It is a good plan to give a nucleus of frame of eggs or unsealed brood when the young queen is four or five days old. If some bird has caught the queen on her wedding trip, or if some other ill has befallen her, such as entering the wrong hive, the bees will start queen-cells from this young brood, and by that you may know there is no queen present. This young brood seems also to have a sort of stimulating effect on the bees, and it is believed it may hurry up the young queen in her work of laying.

PRE-CONSTRUCTED QUEEN-CELLS.

The kind of queen-cells we have been talking about so far are those that are built in a hive while a laying queen is present. Besides preparing for swarming, such cells are built when the old queen is to be superseded. In the natural course of events, every queen is superseded by the bees when three or four years old, sometimes when the queen is only a few weeks old (although in such case it is probably because the queen is not a good one), and sometimes a queen is not superseded until five years old, and in rare cases a queen may continue longer. Something depends on the seasons. A queen in a large colony in a prosperous season will not live so long as one that has been in a small colony or that has had seasons when little work was done. These cells prepared by the bees while a laying queen is present, whether for swarming or supersedure, are called *pre-constructed* cells, and such cells are usually built on the edges of the combs, or where there is some hole or irregularity in the comb. The base of a pre-constructed cell is always rounding and not angular like the base of a worker-cell. When the young queen has emerged from a queen-cell, or has been destroyed in it, the cell will in a few days be torn down by the workers, leaving only the base or cup of the cells. Such cell cups are frequently started by the bees and never completed, and you may find a number of them in almost any colony.

POST-CONSTRUCTED QUEEN-CELLS.

If a queen be taken from a hive at a time of the year when she is laying, the bees will proceed to rear a successor. A young larva will be selected in a worker-cell, more commonly a number of them, and fed lavishly what is called royal jelly. Scientists tell us that there is no difference whatever between an egg laid in a queen-cell and one laid in a worker-cell, also that the food fed to a worker-larva during the first three days is the same as that fed to a queen during the entire time of larval feeding. After the first three days a worker-larva is "weaned;" that is, it is fed a coarser food that is not so fully digested, but the queen is fed throughout on the better food, and fed so lavishly that generally quite a bit of the royal jelly is left in the cell after the young queen emerges. So the queenless bees feed the young worker-larva that they have selected, on the royal jelly throughout the entire feeding period, enlarge the cells over them, and the result is that what would have been workers had the queen not been removed now turn out to be queens. These queen-cells that are constructed after the larvae are first started in worker-cells are called post-constructed cells.

It is not easy to distinguish a pre-constructed from a post-constructed cell by looking at it from the outside, but you can always distinguish them by tearing down each cell and looking at its base. The bottom of a pre-constructed cell (the kind always used for swarming or superseding) is always smooth, like the side bottom of a tea cup, while the bottom of a post-constructed cell (the kind always built when bees have lost their queen) is three-cornered, the same as the bottom of any worker-cell. The location of a post-constructed cell may be on the edges of combs, but sometimes they may be found right in the middle of a brood-comb, and in this case they may project so little above the surface of the comb as not to be seen on a hasty examination, and yet from such an inconspicuous cell there may emerge a nice, large queen.

As to the quality of queens from post-constructed cells. Taken as a whole, they are far inferior to others. The best of queens are reared only when weather and pasturage are at their best. You cannot rear a good queen when weather is so cold that bees can fly only every other day. Bees do not start queen-cells for swarming or superseding when weather and pasturage are unfavorable. Sometimes they start queen-cells preparatory to swarming, and the weather becomes very bad or the harvest ceases, upon which they destroy the queen-cells and give up swarming until a more propitious time. But post-constructed cells are built as a matter of necessity; the bees feel that a queen must be reared or the colony will cease to be, so they proceed, no matter what the weather or harvest may be.

There is another reason why all the queens reared, because the bees are forced to rear them, are not as good as when there is no necessity in the case. As already said, for the purpose of rearing a successor when a queen is lost, the bees select a larva sufficiently young. Although only one queen is needed, several are started, so as to make the matter more sure. Not content with that, they continue to start queen-cells later on, even when no larvae sufficiently young for the purpose are present, and queens will be reared from larvae so old that they will seem part queen and part worker. Indeed, so desperate are the bees as to rearing a queen, that if they have nothing but drone brood they will try to rear a queen from a drone larva. Of couse, the poor fellow can be nothing but a drone, no matter how royally fed, and, generally, if not always, he dies in the cell.

While it is true that as a whole queens from post-constructed cells are inferior, it still remains true that some of such queens may be as good as the best. Let a queen be removed from a colony at a time when other colonies are swarming freely, and if that colony is left to itself there is no reason why it will not rear as good a queen as the very best it would have reared if the queen had not been removed and the colony had swarmed. The queen-cells first started will be all right, and as they will be first to mature there is no danger that the colony will have a queen from the poor trash started later on.

It is very important that this matter be fully understood; if queens are forced to be reared by unqueening a colony at a time when weather and harvest are not favorable, you need expect no good queens, and under the most favorable circumstances you can expect nothing but poor queens from larvae that were too old when selected; also, you may have the best of queens reared from proper larvae under proper conditions.

STARTING QUEEN-CELLS IN QUEENLESS COLONIES.

Understanding thoroughly this matter of post-constructed cells, it is easy to see that you may secure a lot of queen-cells by simply removing a queen from its colony. Do not think of beginning this too early in the season. It is time enough when bees begin to swarm. Neither should it be done after the harvest is over. You may, however, create an artificial harvest after the clover harvest is over, by feeding the colony daily half a pint of honey or sugar syrup. But do not try this in the spring, for the weather is too cold then.

Do not make the mistake of thinking that a very weak colony will do to start cells. It is true that you may have a single frame of brood in a hive with bees enough to cover it, and have a cell started and a queen reared, but such queens would not be worth a cent a dozen. Remember that the queen is the keystone of all successful bee-keeping, and that you cannot afford to have poor queens, so you can well afford to have queen-cells started in a strong colony.

Of course you will want queens reared from your very best stock, so you will be likely to take the colony that has your best queen. Sometimes, however, it may happen that you may want more cells than your best colony would rear, and still you want to use that stock, or for some reason you may desire to rear from your best stock without disturbing its queen. In that case you may resort to *grafting*. Suppose you have made queenless a strong colony which does not contain your best queen. Two to four days later you will get from your best queen a frame of brood containing very young larvae, this frame to be returned after you have got what you want from it. Of course the weather must be hot enough so there will be no danger of chilling the brood. Go with this frame of brood to your queenless hive, take one queen-cell after another, take out the larva in the cell and put in its place a larva from your choice queen. A quill toothpick may do for a tool, or you may take a stalk of timothy and cut it in the form of a quill toothpick. You will find it an easy matter to get the larva from the queen-cell, and not very difficult to pick a larva—take a very small one—out of your frame of choice brood. Set this larva right in the jelly where the first larva was. The bees will generally treat the grafted larva just as if there had been no change.

One advantage about this grafting is that you may thus be sure that all your queens are reared from larvae that are not too old. It may be a good plan for you to mark each grafted cell, so you can be sure of their identification. Take a pin or, better still, a slender one and one-half inch wire nail, and thrust it into the comb directly over the cell.

GETTING QUEEN-CELLS BUILT IN A COLONY WITH A LAYING QUEEN.

As already stated, when a colony learns its queenlessness, it proceeds to rear a queen. It is also true that if one or more frames of brood belonging to a colony are so situated that the queen is some little distance from them, the bees on such combs seem more or less inclined to consider themselves queenless, and may take steps to rear a queen. The more distant the queen seems from them, the more likely they will be to want to rear a queen. If a colony has two stories of brood combs, or even only a single comb of brood in the upper story, there being a queen excluder between the two stories and the queen being in the lower story, quite frequently the bees will start queen-cells on the brood above. If the queen be an old one that the bees are likely to be superseded shortly, the impulse to rear queens will be stronger.

While it is not safe to rely on the rearing of queen-cells in the way mentioned, it is tolerably safe to count on the bees rearing queens over an excluder if the cells are first started in a queenless colony. With an old queen about to be superseded, the per cent. of cells carried to completion will be large.

Queen breeders who make a business of rearing queens on a large scale make a practice now-a-days of using artificial cell cups in which a very young worker-larva is transferred or grafted, generally preceding the larva by a small amount of royal jelly, and a number of such cell cups, perhaps, to the amount of twenty or thirty are fastened on a stick and put in an upper story, when the larvae will be fed in a royal manner, and the cells carried on to completion and sealed. To go minutely into the matter would be going outside the purpose and limits of this little work.

Of course it should be understood that a number of queen-cells may remain together in safety, but not a number of queens. One queen is all that can be kept in one inclosure, for queens, especially virgin queens, have a deadly animosity to one of their own kind. If you take away the queen from a colony, a number of queen-cells will be started, but if you wait about twelve days before opening the hive, you will be likely to find only one queen left. Either the workers have destroyed them, or they have fought it out among themselves until only one remains. It may be remarked in passing, as a curious fact, that in the combats of queens the victorious queen is not injured in the struggle. When the mortal sting is given by the victor, her vanquished opponent is in such a position that she cannot, or does not, sting her conqueror. So, if you want to save more than one young queen, you should remove the queen-cells about the ninth day, although the tenth day is usually pretty safe.

NUCLEI.

While it is practicable to carry on bee-keeping with full colonies entirely, it is many times convenient or economical to have a small number of bees in a hive, a very small colony being called a *nucleus*, the plural of nucleus being *nuclei*. Nuclei are especially desirable in the matter of queen-rearing. Ten, twenty, or thirty queen-cells may be in a hive together, but as soon as the young queens begin to emerge from their cells there must be a separate domicile for each. Something like two weeks will elapse from the time the queen-cells are taken until the young queens are to be used as laying queens, and sometimes it may not be convenient to use them then, and during that space of two weeks or more a young queen is just as well off in a nucleus of two frames as in a full colony. It is not well to have less than two frames of brood in a nucleus, experience showing that in a weaker nucleus the young queen does not do so well, being more likely to be slow in beginning to lay, and more often disappearing.

A small hive with frames much less than the usual size may do for a nucleus, but now-a-days it is considered better to use hives and frames of the regular size. The frames you have put in will be on one side of the hive, and you will hang beside them a dummy, in order to close them up. A dummy is merely a board of the same size as a brood-frame, having a top bar of the regular length. The thickness of the dummy may be anywhere from three-eighths to one inch.

You may take from any colony two frames of brood with adhering bees and put them on a new stand in an empty hive, and you have a nucleus. But if you open the hive two days later you may be saddened to find every bee gone from your nucleus. The field bees all go back to the old hive the first time they return from the field, and as soon as the little colony discovers its queenless condition there is a commotion, and all the bees that had already marked the location at the old hive make their way back there. Those that are so young that they have never marked the old location become so discouraged and demoralized that they desert the hive, probably joining some of the nearest colonies.

So there must be some pains taken to make the bees of the nucleus stay where they are put. One way is to pen the bees in the hive so not a bee can escape. Stuff green leaves into the entrance pretty tightly. Next day pound the hive with the fist or a heavy stick for a minute or two, then open the entrance. The bees in their excitement will mark the entrance, and are then all right.

Another way. Take from a full colony three frames of brood with adhering bees and the queen, and put them where you want your nucleus to stand. Two days later return the queen and one of the frames of brood to the old hive. Take with this frame of brood only so many adhering workers as will leave the nucleus with plenty to cover the two frames of brood.

The matter will be very much simpler and easier if you have queenless bees to deal with, for such bees are quite likely to stay wherever they are put, and it is not difficult to have queenless bees at any time. If you do not happen to have any queenless bees, you may proceed as mentioned in the last paragraph, only before you return the queen with the one frame of brood form what nuclei you wish by taking for each nucleus two frames of brood with adhering bees. Not many bees will return to the old stand, yet there will be enough so that if the queen on the old stand has only one frame of brood the colony will soon build up to respectable strength.

As a matter of economy, two nuclei may be in one hive. They will not only do as well as if in two separate hives, but they will do better, for there is a decided advantage in the mutual warmth. The greatest difficulty in the case is to have a perfectly bee-tight partition or division board in the middle of the hive. If there is a hole anywhere in, under or at the end of the division board large enough for a bee to crawl through, the two nuclei are likely to unite. Close up the entrance all but an inch or two at each end, so that no bee can enter except at these two places at the ends. Put the frames of brood next to the division board, so that the two nuclei will form a single cluster with the division board in the middle of the cluster. The division board ought not to be more than one-fourth to three-eighths of an inch thick.

BALLING OF QUEENS.

If without any preliminaries you put a strange queen into a colony that has a laying queen, or one whose queen has been removed only a few hours, you may count pretty surely that the queen thus introduced will be killed. If a strange worker enters a hive and is executed for its intrusion, the process will be short and sharp, the worker being immediately stung to death. Not so with a queen. One bee will seize it, then another, and another, until there is no room for any more bees to get hold of the queen, and then other bees will seize the bees that have seized the queen, the little cluster holding so firmly together that they are with difficulty pulled apart. This is called balling the queen, and the ball may be as large as a black walnut. When the queen has been balled a sufficient number of hours she will be found dead, possibly from suffocation, more likely from starvation.

If you find a queen ball and still alive, you may rescue her if you go at it in the right way. Do not try to pull apart the ball by main force. You may injure the queen, or the bees may sting her. If you throw the ball into a dish of cold water, each bee will do its best to save itself and the queen will be freed. Perhaps a better way is to throw the ball on the ground and blow smoke upon it from a smoker. Hold the smoker some distance from the cluster, so the smoke will be cool when it strikes the bees. If you blow hot smoke upon them, they will pretty surely sting the queen.

Sometimes bees ball their own queen that has been in the colony all her lifetime. This occurs more frequently in the spring. When you open the hive, the bees seem to be frightened, and whether to protect the queen or for some other reason, they ball her, and if you try to rescue the queen you will make matters so much the worse. Just leave the queen in the ball, close the hive as quickly and quietly as possible, and do not open it again for a day or so, and then you will almost surely find the queen safe and sound.

INTRODUCING QUEENS.

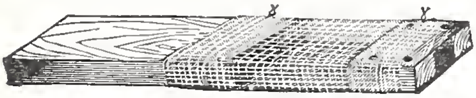
Getting a colony of bees to accept a strange queen—introducing a queen, as it is called—is an important matter in bee-keeping. Sometimes you will succeed with scarcely a precaution, and sometimes you will fail after taking great precautions. As a rule, bees will accept a strange queen only when they have been long enough without a queen to recognize their queenlessness. It is easier to introduce a queen when bees are busy storing. It is safer to operate in the evening, after bees have stopped flying, for earlier in the day they are on the lookout for robbers, and the queen is more readily recognized as an intruder. Bees that have no brood in the hive from which they can rear a queen are the more ready to accept one.

In the working season, when bees are busy storing, if a colony has been queenless two or more days, you may take from a nucleus a frame of brood with adhering bees, the queen among the rest, put the frame in the hive with no precaution whatever, and generally there will be no trouble.

If a queen be rolled in a spoonful of liquid honey so as to be thoroughly daubed all over, then dropped into a queenless hive in the evening between two frames so close together that she is in no danger of dropping to the floor board, she will generally be accepted.

Put a queen in a wire-cloth cage, and put the cage in the middle of the brood-nest between two frames, or directly over the top bars, and leave her there about two days. Then, upon opening up the hive, if you find the bees acting in a friendly manner toward her as if trying to feed her, you may release her from the cage. If, on the other hand, they act in a hostile manner as if trying to ball or sting her, leave her in the cage for a day or two longer.

Perhaps the majority of queens now-a-days are introduced by means of cages so prepared that the workers themselves will liberate the queens in the course of a day or two. Most of the queens sent by mail are in cages of this kind. There is an advantage in having the bees themselves liberate the queen, for when the bee-keeper himself opens the hive to do it, there is more or less excitement, which endangers the queen.



MILLERS'S INTRODUCING CAGE.
From Root's ABC of Bee Culture.

When a queen is not to be mailed but merely introduced, a cage simpler than the usual shipping cage will do as well or better. Miller's introducing cage can be had of supply dealers for 10 cents, or you can make one yourself as follows: Take a block 3 inches long, $1\frac{1}{4}$ wide, and $\frac{3}{8}$ of an inch thick; two blocks 1 inch by $\frac{7}{16}$ by $\frac{3}{8}$ of an inch; two pieces of tin about an inch square; a piece of wire cloth $4\frac{1}{2}$x$3\frac{1}{2}$ inches; two pieces of fine wire about 9 inches long, and four small wire nails $\frac{1}{2}$ or $\frac{5}{8}$ of an inch long. That's the bill of material. Lay down the two small blocks parallel, three-eighths of an inch apart, one piece of tin under and one over them. Nail together and clinch. These two blocks, being three-eighths of an inch apart, make the hole to fill with good candy, through which the queen is liberated.

You will readily see that the queen can not get out of the cage until the bees have eaten out the candy with which you have closed the passage. The candy is of course packed in previously, and the large block is to be pulled out to admit the queen. In order to make the time longer for the queen to be liberated, it has become the practice to tack a piece of rather thin pasteboard over the place where the workers are to get at the candy. A few small perforations are made in the pasteboard, or else it is nailed on so that it does not entirely cover the candy at one edge. This tempts the bees to get at the candy, and they will spend perhaps a day in gnawing away the pasteboard.

While not more than one queen in a hundred may be lost in the plan last described, still it is not entirely certain, although perhaps the safest of the plans mentioned. If a valuable queen is to be introduced, it may be worth while to use a plan that is more troublesome but entirely safe. Put into an empty hive two or more frames of brood with young bees just hatching out, but with no unsealed brood. Put the queen in this and close the hive bee-tight, and keep it in a warm room for five days. By that time a respectable force of young workers will be present, and the hive may be placed on the stand where it is to remain and the entrance opened. As a matter of precaution against robbers, make the entrance large enough for only one bee to pass at a time. Instead of taking the hive in the house, it may be placed over a strong colony with wire cloth between the two hives to prevent passage from one hive to the other.

When a colony has been queenless long enough to have queen-cells well under way, it is not so easy to introduce a queen, and when it has become so hopelessly queenless that a greater or less number of workers have assumed the duty of egg-laying it is hardly worth while to attempt the introduction of a laying queen. That is one of the reasons why it is advised to break up a colony with laying workers. Such a colony may, however, accept a queen-cell, and some have reported success by dropping into the brood-nest a virgin queen not more than an hour or two old. It is a curious fact that while bees are so loyal to their own queen that they will not tolerate the presence of a stranger, a very young virgin queen may be put into any hive without being molested so long as she remains young. As soon, however, as she attains a little age, perhaps when a day or two old, she is no longer tolerated, perhaps, because at that age she begins to feel the royal blood stir within her, and has sinister designs upon the reigning sovereign.

TWO QUEENS IN ONE HIVE.

While it is the rule that only one queen will be allowed in a colony, it is not such a very uncommon thing to find a mother and daughter laying peaceably side by side. This will be in a case where the old queen has become superannuated and yet lingers on a short time after her successor begins to lay. But in a few days the older queen is likely to be missing. The possibility of such a thing should be thoroughly understood, for sometimes it may happen that a queen is bought and lost on being introduced, just because the owner had killed one of the queens without suspecting the presence of the other. It is well to have the wings of laying queens clipped, for then one has a chance to tell something about it when there has been a change of queens. While there may be such a thing as two queens not mother and daughter being in a colony at the same time, the case is very rare indeed.

ARTIFICIAL INCREASE.

While the majority of those who keep bees on a small scale depend upon natural swarming for increase, there may be circumstances that make it desirable to increase without depending on swarming. There is a great difference in different bees as to the tendency to swarming, as a general rule, the best workers being least disposed to swarm, and some think it not entirely impossible that we may yet breed a strain of bees that will be practically non-swarming. They say, "Non-sitting hens have been bred, why not non-swarming bees?" Even as it is now, there are colonies that have not swarmed for several years in succession. In such case it will not do to depend entirely upon natural swarming. Indeed, it may be desirable to resort to artificial increase even when there is all the amount of increase desired from natural swarming. For it is not merely the amount, but the kind that must be considered, and the colonies most inclined to swarm are not likely to be the best workers, while the best workers, the very ones we want to breed from, are the ones that give the fewest swarms.

Fortunately it is not a difficult thing to multiply colonies without any natural swarming. Indeed, such multiplication is altogether too easy for most beginners. No other mistake is so likely to be made by the novice who has once made a beginning at artificial increase as to increase too rapidly. He closes the season with a large number of colonies, to be sure, but they are weaklings that will not endure the winter, and the following summer finds him no farther ahead than a year previous. If, instead of making a three or four-fold increase, he had been satisfied with an increase of 50 per cent., he would have got on more rapidly in the long run. There are two things that can hardly be insisted upon too much for a beginner to observe: 1. Go slow in the matter of increase. 2. Be sure that every colony before winter sets in has abundance of stores.

Knowing that bees without a queen will proceed to rear one if they have young brood present, the beginner will understand how easy it is to start a new colony. He need only take part of the brood and the bees from a hive and put them in a new place and the work is done; the bees will do the rest. And if the colony be divided up into two or more parts, there will be more new colonies; so, if there are eight frames of brood in a hive, he will start eight new colonies, each one having one frame of brood. In the course of time he will learn that all is not gold that glitters. If no precautions are taken, the bees will not stay with the brood when put in a new place. Some of his little colonies will fail to rear queens. Some of them will rear queens that will disappear before they get to laying. Those that do succeed in rearing queens that lay will have queens of little value. So he will be worse off than if he had attempted no increase.

Before attempting any considerable increase in the way indicated, it would be well to study carefully what has been said about queens and nuclei. Remember that the queen is the soul of the colony; that without a good queen there is no such thing as succees, and that a good queen will not be reared by giving young brood to a mere handful of bees.

It would take up entirely too much space to give all the plans for artificial increase, or artificial swarming, as it is sometimes called. A few may be given here, and the reader will be the judge as to what will best suit his needs. With experience, other plans will suggest themselves, or modifications and combinations of these.

SIMPLE DIVIDING.

About the simplest of all ways is to take one-half the combs with adhering bees from a colony and put them in an empty hive on a new stand, filling up the vacant space in each hive with frames filled with foundation. No matter which half the queen is in, the other half will have bees enough to rear a queen.

While it may be all right to do nothing more, leaving the bees entirely to themselves, it will be a much safer plan to take a little more pains, and thus make more sure of success. Let us give a little attention to what will be done when this division is made. Suppose the queen is left in the half that remains on the old stand. The bees in the other hive, feeling keenly their queenlessness, will, mostly, within the next forty-eight hours return to the old stand, leaving so feeble a force of workers that the brood may be chilled, and such a feeble, discouraged lot of bees can not be expected to rear a good queen. The matter may be helped by fastening the bees in the hive for a day or two, thus leaving a stronger force in the hive, but during that day or two no honey will be carried into the hive, and no colony will do its best at queen-rearing when there is no harvest coming it.

Suppose the queen is taken with the bees that are moved to the new stand. In that case there will not be the danger of such wholesale desertion, but still all the field bees for the next two days or so will leave the queen and go back to the old stand. That will work well for the queenless part, giving them a chance to rear a good queen, for the bees will be strong in number, and plenty of honey will be coming in. But it will be about three weeks before the young queen will be laying, and it would be most profitable if the laying queen could be with this stronger force of bees during that time.

A compromise can be made. We want the young queen to have the best chance, the most important time in her rearing being the time when she is fed in the larval state. So leave the queenless part on the old stand for a week, then let the two hives swap places. That will give the old queen on the old stand the strongest flying force left by the old queen at the stand where the queenless bees now are. But after a little experience you will not be likely to use this plan.

THREE COLONIES FROM TWO.

A plan that is nearly as simple, and that is at the same time safer as well as giving a better chance for a honey crop, is to use two colonies so as to get a third from them. Suppose two colonies strong in bees, A and B. If conditions can be exactly to our liking, A will have a queen of the best stock, and B will be the strongest colony in the apiary. About the time the clover harvest begins, take from A all its frames except one, brushing the bees back into the hive, and replacing the combs with frames filled with foundation.

The one comb left is to guard against the chance of starvation if two or three bad days should occur, and it will be one of the outside ones containing honey. These frames are put into another hive that we will call C. We have now a hive containing brood but no bees, and the vacancy in it is filled with a frame of comb or foundation. It is then placed on the stand of B, and B is removed to a new stand. If this change be made late in the day, there will be no bees to take care of the brood in C, and during the night many will be chilled and starve. So we must operate in the forenoon, and throughout the day there will be a constant return of B's field bees to cover the brood in C. Perhaps the very best time would be to watch when B's bees were having a play spell. At that time many of the *younger* bees are out, and would join C and young bees are better for starting queen-cells. However, even field bees can do housework if forced to it, and there will be a host of young bees hatching out ever day. So if it is not convenient for you to operate at the time of a play spell, take some time in the neighborhood of 9 or 10 o'clock.

You ought now to have three good colonies instead of two. A ought to be better than a natural swarm, for it is much the same as a natural swarm, only it has all the bees of a colony instead of part. B will become strong again very shortly, and may do good work in supers if it does not swarm later on. C has all the flying force that was in B, and although it will be about three weeks before the young queen gets to laying, there will be during all of that three weeks the same lot of young bees hatching out daily that would have hatched out in A if no change had been made. The drawback comes to C after the three weeks are up, for there will then come another three weeks during which not a bee will hatch. This can be helped if at the time of making the change a mature queen-cell or a queen be given to C.

About the time the young queen is expected to begin laying, if C rears its own queen, it is well to give C a frame containing young brood. This seems to act as a stimulus, and at the same time helps you to determine whether the colony is all right as to its queen. If the queen has been lost, you will find queen-cells started, and you may allow these to go on to completion unless you can help them with a young queen or mature queen-cell.

Under ordinary circumstances you need not expect as much surplus from these three colonies as you would have had from the two *if* neither of the two had swarmed. As a compensation you have the additional colony. If, however, there should be an excellent fall flow, the three combined may give more than the two would have given.

A modification of this plan is, instead of taking all the brood from one hive, to take one or two frames each from several hives, and when you have a hive filled with them to set it in place of a strong colony.

INCREASE BY NUCLEI.

A favorite plan with many is to commence with a nucleus and let it build up into a full colony, giving it help if needed.

Here is one way: From a strong colony, A, take two frames of brood and bees, putting them in an empty hive B, and set this in place of A, putting A in a new place. Three days later, do the same thing again, taking two frames of brood to make C, setting C in place of A. Three days later still, repeat the operation, making D, and setting it in place of A. Three days later still, let A and B change places. You now have three good nuclei, and A will be again strong enough so that from time to time you may take from it a frame of brood to strengthen one or other of the nuclei. Each nucleus can rear its own queen from the start, but you will get on faster and have better queens if you give each nucleus a good sealed queen-cell started in a full colony.

Here is another way, in which you will not need to look elsewhere for queen-cells: From a strong colony of good stock, take two frames of brood with adhering bees and the queen, and put them in a new hive in a new place. Eight or nine days later, divide the old colony up into nuclei, setting each nucleus in a new place, allowing one of the nuclei to take the place that has been occupied by the queen for the last nine days, and setting the hive with the queen back on the old stand. Of course, you will see that each nucleus has two or more good queen-cells in positions where there is no danger of their being chilled, as heretofore advised.

After reading up the subject under the head of Nuclei, you will be ready to form several nuclei by means that you think best. Suppose you have five of these nuclei started. As already instructed, you will have a queen reared in each of them. A week or so after a nucleus is started give it a frame of brood without reference to the condition of its queen. Then a week or ten days later give it another frame. By this time it has a laying queen, if you gave it a mature queen-cell in the first place, and when you give it the frame of brood it will be a gain to give some bees with the brood if they can be spared. It has now four frames of brood, and if it is not too late in the season it ought to be able to build up without further help.

Very likely you may ask where you are to get frames of brood to give to these nuclei. One way is to take all the brood from a colony and divide it among the nuclei. That is not the best way. Take away only enough to leave at least four frames of brood in each hive from which you draw. If that will not give you as many frames of brood as you would like for your nuclei, then be satisfied to make a smaller number of nuclei. Set it down as a matter of very bad policy to make your full colonies too weak by drawing brood from them. Always leave four or five frames of brood in the hive.

Your greatest danger will be in starting too many nuclei. It is so easy to make them that you will be likely to have a whole lot without enough to help to build them up, and then winter will catch you with a lot of weaklings that will be gone by Christmas. You will get on faster in the long run if you go slower at the start.

When you find you will not need to give any more help to the two, three or more nuclei you have started, because they already have four or more frames of brood each, then you may start more nuclei. When the first formed nuclei have five or more frames of brood, then you may draw brood from these to start fresh nuclei or to strengthen those already formed. Thus you may keep on, always keeping an eye out for the close of the season, being sure to get all built up before the seasons becomes too late. You may count pretty certainly that you will try to increase too much, and will have some weaklings to your sorrow, and it may do little good to warn you, but please remember that you did not do so without warning.

You have been told to start a nucleus with two frames of brood. Three would be better, and you will always keep in mind the possibility that many of the bees will be likely to return where they were taken from, so besides the bees that adhere to the combs taken it may be well to take a few bees from the other combs. Two or three frames of brood have been mentioned, but it is always well to have also a comb of honey to start a nucleus. There is something about it that keeps them in better heart, aside from the fact that without a frame of honey the bees may starve. When a nucleus is first started, it is wise to allow a very small entrance, for robbers are likely to be on the lookout, and any newly placed nucleus receives from them special attention. On that account it is never safe to form nuclei at any time when honey is not coming in pretty freely, for there is always less danger of robbing when bees find work in the field.

RENDERING BEESWAX.

If you work for extracted honey, it will be an easy matter to get from the cappings a nice cake of beeswax. A good deal of beeswax may also be got by saving all scraps of comb, and sometimes whole combs may be melted up because crooked or containing too much drone comb.

It is somewhat difficult to get all the wax out of old combs, because the cocoons act like so many sponges, taking up the melted wax. To avoid this, at least in part, old combs should be soaked in water until the cocoons are saturated, and then they will not take up the wax. If they can be frozen after being thus soaked with water, they can then be broken up into small pieces. Without this breaking up, the cocoons, even if saturated with water, will act as little cups to hold the wax.

The cheapest wax extractor you can buy will cost you two or three dollars, and if you have no great quantity of wax to extract you can get along very well with nothing but a square tin pan split open at one corner. Put your bits of comb to be melted into the pan, and put the pan in the oven of a cook-stove. Let the open end of the pan project out of the oven, of course leaving the oven-door open, and put a stone or something under the end of the pan that is in the oven, so that the melted wax will run out, and set a dish under the dripping corner to catch the wax, having a little water in the bottom of the dish. Avoid having hot wax in iron, as it blackens the wax. Do not spoil wax by overheating.

When you have rendered the wax out of the combs, there will be more or less impurities in it. If the wax is melted and allowed a long time in cooling, that will give the impurities a chance to settle, when they can be scraped off the bottom of the cake. Here is a good way: In the evening, when there is no longer so hot a fire that there is danger of making the wax boil over, put the dish of wax in the cook-stove oven and close the door. Let it stay there all night, but be sure to take it out in the morning before kindling the fire.

To clean wax from utensils, heat until the wax is very soft, and then wipe off with old newspapers. Benzine will dissolve it so it can be wiped off with a cloth.

ROBBING.

Bees are symbols of industry, and if there is any time when they especially deserve credit for industry and perserverance it is when they get thoroughly started at robbing. Do not believe the foolish assertion that there is no danger that a colony of your bees will not rob another in the same apiary. The matter of ownership does not concern them, and they will be more likely to attack a colony near by than one at a distance.

As in many other cases, prevention is better than cure. Be careful to do nothing to start robbing. A comb of honey or brood left standing exposed for a short time when little or nothing is to be gathered in the fields may start the whole apiary into a furore. When honey is coming in freely, there is comparatively little danger. Perhaps the worst time is at the close of a harvest, when the bees are suddenly stopped from gathering in the field, and make every effort to find a place where they can get something for nothing. If at any time when honey is not coming in you have opened a hive, and find the robbers pouncing in, you may do well to close up for the time being. No use to try to drive the robbers away with smoke. You may for the time being drive them away, but you also drive away the bees of the hive as well, and make them unfit to defend their stores.

Weak colonies and those that do not have laying queens are objects of particular interest to robbers. Try to keep all colonies strong, and if you must have a weak colony in a time of scarcity, see that its entrance is only large enough for one bee to pass at a time. If in the spring you find a weak queenless colony being robbed, it is often the best plan to let the robbers entirely alone and let them finish up the job. If you take the hive away, the robbers will pitch fiercely into the nearest hive, but if you let the hive stand, the robbers will work at it until nothing is left, and gradually give it up. If there is much honey in the hive, you may take most of it away, but leave the hive unmoved for the robbers to work at. Sometimes the robbed bees will turn in with the robbers and help them.

But it is not always desirable to allow the robbers to have their own way. Sometimes some carelessness on the part of the beekeeper may start robbing in the strongest and best colony in the yard, and every effort should be made to stop them. Pile hay or straw at the entrance and at the sides of the hive, piling it as high as the top of the hive or higher, and sprinkle it thoroughly with water. The robbers do not like the wet, and they do not like to work their way through such a difficult passage, while the bees of the hive will force their way through. Keep everything thoroughly wet until the robbers stop, which may not be until sundown. Italian bees defend themselves against robbers better than black bees.

WATER FOR BEES.

Bees use a great amount of water. Nectar, as usually gathered from the flowers, contains a large proportion of water, and while the bees are busy on this they have no need of water besides. But in a very dry time, or when no nectar is coming in they will often be found returning to the hive with water alone in their honey-sacs. In spring time, before the flowers yield nectar, many bees may be seen along the margins of small streams, busily sipping up water from the sand and pebbles to carry to their hives. The weather being raw and cool, accompanied perhaps by high winds, these journeys for water are perilous, and thousands of bees thus sacrifice their lives, especially if they must travel a great distance. Some think it worth while to make the work less dangerous for the bees by furnishing a supply of water near by in some sheltered spot. One good way is to furnish water in the same way that syrup is fed. (See Crock-and-plate feeder, page 30). Another way is to take a large crock and fill it nearly full with sticks of firewood set endwise (all the better if the wood is rotten), and then fill up with water. If you simply give them a crock of water, they will drown in it.

If you get them started to getting water at a particular place in the spring, they will continue to go there all through the season, unless you let the water dry up for a day or so. One advantage of having a regular watering place for the bees is that you thereby avoid the annoyance of having them gather toward the end of summer at the pump or at the watering trough. Horses dislike bees very much at their watering troughs, and are sometimes stung by the drowning bees.

ENEMIES OF BEES.

Aside from the ignorant and careless bee-keeper, no enemy of the bees has been considered worse than the bee-moth or wax-worm. Since the introduction of the Italian bee, however, this enemy is little to be dreaded so long as combs are in the care of the bees, provided the bees are as much as half Italian blood. Indeed, even with black bees there is no occasion for anxiety if the colonies are strong. If a colony is so weak that it cannot cover more than one-half its combs, then the moth has a fair chance to lay its eggs without hindrance in the unoccupied combs, and the heat from the bees is just the thing for the comfortable growth of the little worms that hatch from the eggs. If the bees are black it may not be long until all the unoccupied combs are consumed, leaving in their place a lot of webs, cocoons, and fat worms an inch or so long. If, however, the bees are Italian, they will scout around over the unoccupied combs, and pick off the little worms before they become of sufficient size to do any serious damage.

Very often the worms have more blame laid to their door than fairly belongs to them. A man says: "I had a rousing good colony that sent out three swarms, and the first thing I knew the worms got at it, killed the bees and finished up the whole business. That's the most discouraging thing about bees; the worms kill so many of them every year." And he thinks he is telling the truth when he says the worms or the moth killed his strong colony; the truth being, however, that it was greatly weakened by sending out three swarms, and failing to rear a laying queen, the discouraged bees died off, and left the worms in full possession of the combs. It would be just as reasonable for him to say that maggots had killed a horse if he should find one filled with them a few weeks after it had been shot.

As prevention is better than cure, it will be easy to understand that the main thing is to avoid giving encouragement to the breeding of worms in combs. Do not have combs or pieces of comb lying about as breeding places. Especially do not have a weak colony or nucleus of black bees in a hive that is filled with combs. Keep Italian bees, and follow the golden rule, "Keep all colonies strong," and you can snap your fingers at moth and worm. Something more as to the treatment of worms will be found under the heading, "Care of combs."

Ants are somewhat serious enemies in the south, but as far north as this the most that can be said of them is that they are troublesome. Perhaps they are more troublesome to the bee-keeper than to the bees. Some bee-keepers have quilts over the brood-frames, although now-a-days there is nothing generally but an air space of one-quarter of an inch between the top bars and the cover. The quilt furnishes a delightful place for the ants to make their nest, the bees not being able to get at them, but furnishing abundant heat for the ants. When the bee-keeper opens the hive, the ants run over his hands and arms, biting him, and they run in among the bees, stirring them up to anger. Sometimes the bees take a curious revenge by seizing the ants, sailing off in the air with them, and dropping them so far from home that they will not find their way back. Aside from the annoyance, the ants do little or no harm, and make their nests in the hive for the sake of the warmth. Have hives so constructed that there is no place in them where a bee cannot get as well as an ant, and the bees will keep the ants away.

Mice commit depredations winter and summer. In winter they make havoc in hives occupied by colonies, whether the colonies are strong or weak. They eat the honey, which is the smallest part of the trouble, for there is greater loss from the combs destroyed by them, and they may even eat the bees. In summer they like to make their nests in hives filled with combs but without bees, and gnaw the combs badly. Such hives should be closed mouse-tight.

So long as bees are active, there is no danger that mice will trouble a colony. When the bees become semi-dormant with the cold, then the mice seize their opportunity. The bee-keeper should head them off by closing the hive against them in time. It will not do to close the entrance against the bees, either in cellar or outdoors, so a good way is to close it with wire cloth of coarse mesh, say three meshes to the inch. Wire nails may answer if the right wire cloth cannot be had. Drive them so they will stand a fourth of an inch apart, and the mice will be excluded while the bees have free passage.

Spiders should not be allowed to have webs near the entrance to catch bees.

Skunks sometimes scratch on the alighting board at night, gobbling the bees as they come out. Stir Rough on Rats or some other poison in an egg and place at the hive entrance. This repeated two or three nights has been said to put an end to the trouble.

Birds have been accused of eating bees, but they are innocent, with the exception of king-birds, bee-martins and possibly a few other insectivorous birds. But these last generally do enough good to compensate. If king-birds appear too troublesome, they may be persuaded to stay away by using the shot-gun argument.

DISEASES OF BEES.

Diarrhoea, or dysentery, is the disease that the bee-keeper most frequently meets among bees. It comes in cold weather when bees cannot fly, and a flight is a cure. Some, indeed, contend that it is not a disease at all, but a mere overloaded condition of the large intestines. Certain it is that when bees fly freely, if it be a disease, can not continue. Bees are cleanly creatures, and like to fly a distance from the hive to empty themselves, but when they do not have this opportunity for a long time their bowels become so distended that they are obliged to empty themselves, and the front of the hive will be spotted by the dark brown excrement, and in severe cases the top bars and combs will be badly soiled. If still no opportunity comes for a flight, the bees will daub themselves and finally die in a filthy mass.

Some of the things that help to bring on diarrhoea may be mentioned. Cold, long continued, is a prime factor, from which it may be understood that a strong colony in a warm hive will be much safer than a weak colony in an open hive or one too large for it. But do not make the mistake of thinking that you may make a colony safe by closely plugging all the cracks and the entrance as well. Plugging the cracks is all right, but the entrance must be left open sufficiently for ventilation or the case may be aggravated. The food eaten by the bees has its influence. Well-ripened honey sealed over will not fill up the bees as will thin, watery stuff unsealed. Honey-dew is often of a character that will bring on diarrhoea in a short time. In some cases it may pay to take away the combs of honey-dew and replace with good clover or linden honey, or with sugar syrup. If comb honey is produced, there is less danger from honey-dew, for the bees generally have a good store of clover honey in the brood-combs. But if the honey be extracted, and especially if the bee-keeper is so unwise as to extract all the early honey from the brood-combs, then the bees may have nothing left to depend on but a bad quality of honey-dew. Cider from cider mills is bad. So is sorghum syrup, and burnt honey; candy or sugar is about as sure death as winter food.

When a colony outdoors is affected with diarrhoea, about the most you can do is to let it alone and long for a day warm enough for the bees to fly. In the cellar it is more likely there is something wrong that may be righted. If the ventilation of the cellar is bad, see to that. The temperature may be at fault. If above 45 degrees, if that is the temperature at which you have found the bees most nearly dormant, then cool it down. Less easy it is to warm it if too cold, but that may be done in most cases. If you cannot make a fire in the cellar, take down hot stones or jugs or bottles of hot water *tightly corked*. Raising the temperature when it is too cold will at least prevent the disease from being as bad as it otherwise would be, and it has even been thought that heating the cellar for a few hours to a temperature of 60 degrees or more acts a little in the nature of a cure. It seems natural to suppose that when a warm day comes, say in February, it would be the part of wisdom to take out of the cellar a colony affected with diarrhoea, and then return it after it has had a flight. In actual practice, however, this does not work well. Let the bees stay in the cellar until they can be taken out for good; but if a colony is badly affected it may be well to take it out a little earlier than it would otherwise be taken out. In any case do not take it out unless the day is warm enough for a flight.

Not so common as diarrhoea, but greatly more to be feared is the dread scourge, *foul brood*. So bad, indeed, is it that if you have only two or three colonies, and all have foul brood, you may about as well burn up all and go out of the business, for at least a time. Whole apiaries of fifty or a hundred colonies have been swept away by it as with a besom of destruction. The disease is highly contagious, and is caused by the presence of a microbe, *bacillus alvei*, If these bacilli or their spores obtain entrance into a hive, the colony is doomed unless vigorous measures are taken. The mature bees are affected little, if at all. As the name *foul brood* indicates, it is the larvae that suffer. The disease most commonly makes its way into new territory by means of honey from a diseased colony. A single drop of honey from a foul-brood colony may carry the disease to a whole apiary. A frame of brood from a diseased colony given to a healthy one means another case of the disease. When a colony has the disease and the owner is ignorant as to its nature, the colony dies or becomes so weak as to be overcome by robbers, and the robbing bees carry the diseased honey to their own hives, thus spreading the disease in every direction. So, if a man has only one or two colonies, he may think it is not worth while to fuss with them and may leave them to their own course: but if he has any honor about him he will want to burn them up for the sake of his bee-keeping neighbors.

The symptoms of foul brood are thus given in Root's ABC of Bee Culture: "Some of the brood fails to hatch. Cappings here and there are sunken and perforated at the center. On opening one of these cells there will be found a dead larva lying on one side of the cell, somewhat shrunken, and of a brown color, varying all the way from a light pale brown to a dark brown. In the more advanced stages the brown is of the color of a coffee-berry after being roasted. In the incipient stages the brown is the color of the coffee we drink, when greatly diluted with milk. But so far all these symptoms may be present as the result of chilled, overheated, starved or pickled brood. But to determine whether it is the real foul brood, run a toothpick into the dead larvae and then draw it slowly out. If the matured mass adheres to the end of the pick, about like spittle—stretches from one-half to one inch—and finally the fine thread breaks when the pick is drawn back, it is probably a case of foul brood. With all other forms of diseased brood, with perhaps the exception of black brood (which, at certain stages, ropes very slightly, but never more than one-eighth of an inch, and the matter of black brood has a jelly-like consistency), this ropiness does not appear, but with foul brood it invariably appears. Now, there is another symptom, and that is the odor, while not exactly foul, resembles greatly that of a cabinet-maker's glue pot, and when the disease is pretty well advanced in a hive, the odor will make itself manifest upon lifting the cover or quilt, even before exposing the brood. If other colonies are affected, and the disease spreads, it is unquestionably foul brood."

It would take much room to enumerate all the foul brood cures that have been offered as sure, only to be rejected after trial. No man living has probably had more experience with foul brood that Wm. McEvoy, foul-brood inspector for Ontario, Canada, and the following is the treatment by which he says he has cured hundreds if not thousands of cases:

"In the honey season, when the bees are gathering freely, remove the combs *in the evening*, and shake the bees into their own hives; give them frames with comb-foundation starters on and let them build comb for four days. The bees will make the starters into comb during the four days, and store the diseased honey in them which they took with them from the old comb. Then in the evening of the fourth day take out the new combs and give them comb-foundation to work out, and then the cure will be complete."

Too great care cannot be taken to avoid the introduction or spread of foul brood. After handling a disease colony, hands and tools must be thoroughly cleansed before touching a healthy colony. It is never safe to feed honey to bees unless you know that it did not come from a diseased colony. There is no way that a diseased comb can be cleansed so as to be used again. It must be burned or buried beneath the possible reach of plough or spade. Opinion is somewhat divided as to whether it is safe to use the hive itself. But all are agreed that frames and combs should be destroyed. If any apparently good honey is found in a diseased hive, it is not affected for table use, only there is the danger that if it is kept for the table the bees may, in some, way, get a taste of it. If water is added to it and it is kept at the boiling point not less than three hours, the honey may be fed to bees. Some would hardly be willing to take that risk. The wax may be rendered and used, providing it is done by a person so careful that no part of the combs or remains get within reach of bees.

Black brood is a disease due to the presence of *Bacillus milii*, modified perhaps, by *Bacillus thoracis*. It bears a resemblance to foul brood both in appearance and destructiveness, but can be distinguished by the fact that the dead larva instead of being glue-like, as in foul brood, is of a jelly-like consistency, and instead of the offensive smell of foul brood it has a peculiar sour-like smell. Instead of drawing out into strings of half an inch or an inch in length, it never strings out to an extent of more than one-eighth of an inch.

Black brood is a disease of only recent acquaintance, and it is not certain that the best treatment has yet been learned. Dr. Wm. R. Howard, an expert bacteriologist, has given much attention to this and kindred diseases, and gives the following treatment:

The best time to effect a cure is during a honey-flow. Adopting a modified McEvoy plan:

"Make your stocks strong by uniting; place them upon comb-foundation starters, and cage the queen. After five days remove the starters and make them into wax, and give full sheets of foundation—keeping the queen caged five days longer. This will give time for all infected mature bees to have disappeared before any brood is reared."

Pickled brood, due to *Aspergillus pollinis*, a specific fungus, is not nearly so much to be dreaded as foul or black brood, and can be distinguished by the fact that the dead larva is *watery*, instead of being like glue or jelly. As to its treatment, Dr. Howard gives the following in The American Bee Journal:

"I have recommended, with successful results, placing the bees on full sheets of foundation, confining them for three days (giving them plenty of water) in order to consume all of the infected material, that none of it might be deposited in the new combs to be covered with new pollen or honey. The disease is infectious, and may be carried by robbers having access to infected combs."

Bee paralysis, due, according to Cheshire, to *Bacillus Gaytoni*, is a disease of the mature bee. An affected bee may be seen at the entrance with its abdomen swollen and its body black and shiny, and at least in the advanced stages having a peculiar trembling movement. It seems inclined to leave the hive, and the well bees show an anxiety to have it leave by tugging at it much as they would at a dead bee.

No reliable cure has yet been found, much to the regret of some bee-keepers in the south who have lost heavily by it. Fortunately, it is not a very serious matter as far north as Pennsylvania, and the bee-keeper need pay no attention to it. A few bees in one or more colonies may be lost by it, and then it may disappear of its own accord. Of course, where many bees in a colony are affected by it, such a colony can not be expected to do very good work.

The beginner is sometimes alarmed at finding a condition that he supposes is due to disease. The larvae are sealed up before attaining the pupa state, but sometimes a row or a cluster of cells will be found unsealed when the young bees are near maturity. These *bare-headed bees*, however, seem as healthy as any, and need give no uneasiness. It is not agreed just what is the cause of the trouble, but some think the bees have been sealed over and then wax-worms have destroyed the cappings.

Another thing that is sometimes mistaken for disease is a little more serious, although not at all a disease. When working on milkweed (Asclepias cornuti), masses of pollen become attached to the feet of a bee, so that it cannot use its feet to climb upon the combs, and is driven out by the other bees. Usually the number of such bees is not great, and it is possible that the amount of honey gathered from the plant may compensate for the loss.

CARE OF COMBS.

Almost any bee-keeper will sometimes have honey-combs that are for a time unoccupied by bees. If through no other cause, he may have colonies die in winter leaving combs empty or occupied by honey or pollen. Such combs are valuable property and will well repay the care required to preserve them. The three principal enemies of unoccupied combs are mold, mice and moths.

Combs kept in a damp, close cellar are likely to be affected by mold. They should not be kept generally in such a place, yet it can not be entirely prevented where bees are wintered in the cellar, for even if no colonies die it may happen that some of the outer combs unoccupied by bees will be covered with mold. Fortunately, the remedy is not difficult. Put a moldy comb next the brood-nest of a prosperous colony in the working season, and you will be surprised to find how soon they will clean it up so you will hardly recognize it as the same comb.

Mice must be kept away from combs by shutting them up in hives or elsewhere so the mice cannot enter. But be careful that you do not pen the mice in with the combs.

The chief villain, however, is the wax-moth. If a colony dies in spring (and it is not in early winter, but in late winter and spring that colonies usually die) and the hive remains unnoticed on its summer stand, it is morally certain that before the summer is over you will find it containing a solid mass of webs and cocoons, with perhaps not a vestige of comb left. You may seal up the hive moth-tight before it is warm enough for a moth to fly, and the result will be the same, for the eggs of the moth by some means have been laid in the hive, notwithstanding the presence of the bees, in the previous fall. It is, howver, not an easy thing to make a hive moth-tight, for a moth will squeeze through a much smaller crack than a bee.

The right thing to do with a hive full of combs upon which a colony has died is to get the combs as soon as possible in the care of the bees. Especially if they are of Italian blood, the bees will make short work of clearing out the worms before they are large enough to do much harm. Perhaps it is putting it too strong to say these combs should be put in the care of bees as soon as possible, for there will be little danger to the combs until the weather has become warm and bees have been flying for some time, say about the time of apple bloom. Take the hive of unoccupied combs, clean out all the dead bees, and put under a hive occupied by a strong colony. If there should be any entrance directly from outside into the upper hive, close it up, so as to oblige the bees to pass through the lower hive in going in and out. Keep the entrance very small the first few days for fear of robbers. If, unfortunately, the hive containing the colony has a bottom nailed to the hive, it may be worth while to knock it off for the sake of protecting the combs. After the colony has had this lower hive in charge for about a week, so as to get it cleaned out and get used to it, you can give it a second hive of combs to care for, putting this second one between the first and the hive containing the colony, so the bees of the colony must pass through both of the hives with unoccupied combs.

If colonies have died in hives in the cellar, there will not be the same need of haste as to getting them in care of the bees. Indeed, it may not be a bad plan to take into the cellar hives whose bees have died on the summer stand, notwithstanding the danger of the combs becoming moldy. In the cellar the worms will hardly get a fair start until it is time the unoccupied combs will be needed to form swarms. It is well, however, to look at them occasionally to see that they are all right, for it is not difficult to see where the worms have run their silken galleries. The question is often asked whether it will do to hive a swarm in a hive in which a colony has died. Unless such a hive is exceedingly filthy, the bees will promptly clean it up, and be saved much labor in building new combs.

It is well to know that freezing destroys both worms and eggs. So a hive of combs that has been left outdoors all winter is in no danger of worms until well along in warm weather, when moths have had time to mature and lay eggs in the combs. If such combs are hung up in an airy place with a space of an inch between them, they will almost surely be safe from worms throughout the summer, and indeed worms *may* not trouble them all summer if left in the hive in their usual position.

If for any reason it is desired to kill worms in combs, sulphur or brimstone is the usual resort. A very little of the fumes of burning sulphur will finish the worms when they are quite small, but when full grown it takes a very heavy dose, so it is well to pick out the larger ones by hand. Take a wire nail and pick open the comb at one end of the silken gallery for half an inch, then commence at the other end and tear it open the whole length. This will drive the worm along till it comes out of the hole you first made, when you can take comfort in ending its existence by what means may seem best.

Fill a pan or kettle partly full of ashes and set into it a smaller vessel of iron. In this put the sulphur and throw on it a shovelful of live coals or a red-hot iron. This must be in an empty hive or some way so it can be enclosed, the hive of combs quickly set over it, and the whole closed so the fumes cannot escape. Now look out, or you will burn up the whole business and, perhaps, the house besides. To keep the heat from setting fire to the combs placed over, put a piece of old sheet-iron (perhaps a piece of old stove-pipe) directly over the burning sulphur.

It must be remembered that burning sulphur destroys only the worms, not the eggs. So it may be necessary to treat the combs a week or two later, when any remaining eggs have hatched. But there is a drug that of late has been used that is said to destroy eggs and all. It is bisulphide of carbon. Put a little of the liquid in a saucer, set it in an empty hive over the combs, then close up tight so as to retain the fumes. But remember that this is a very explosive article, and if the flame of a candle should touch the fumes there might be a terrific explosion.

Combs of honey for table use are not likely to be troubled with worms, but with black bees, especially if the combs are left too long on the hive, there may be some trouble. The dose of sulphur for these may be lighter than for brood combs, and if too heavy a dose is given the white comb will have a greenish color. That, however, does not hurt it for eating.

When extracting-combs are extracted for the last time in the season, it is the practice of most bee-keepers to allow the bees to lick them dry. A hive full of such combs may be placed over a colony, but a surer way is to set the hive at some distance from the apiary and let the bees have free play at it.

UNFINISHED SECTIONS.

At the close of the honey harvest it will always be the case that more or less of the sections will be unfinished, the number varying greatly in different years. It will happen some years that the season will be so poor that none will be finished. Even in the best of years there will be a considerable portion left unfinished, varying all the way from those the bees have not started at all up to those that are filled with honey but have a few cells unsealed.

Those that have not been worked at all by the bees, having no honey at all in them, may be put away until the next year, when they can be used. Be very careful, however, that you do not make the mistake of leaving such sections too long on the hives. When the harvest is over they should come off at once, for the bees will only daub bee-glue upon them, and sometimes to such an extent that they will not accept them the following year. Indeed, some make a practice of taking off all sections at the close of the clover and linden harvest, so as to have none of the later and darker honey in them, and so as to avoid the bee-glue that will be put on them while the bees have nothing to do between the early and late harvests. If a fall flow comes, sections can be again put on, or extracting-combs.

Sections that are not entirely finished will, of course, do for the table, and if to be sold, must be sold at a lower price. Any that are less than half filled with honey should be fed to the bees. If you set out a super of such sections where the bees can get at them, they will promptly carry out the honey, but will be so eager in squabbling over it that they will tear down the tender comb so as to ruin it. Extracting-combs are not in the same danger unless very new. To avoid having the sections ruined for future use, cover them up so as to leave a passage for only one bee at a time to get at them. Better set them five rods or more away from the apiary.

These sections thus cleaned out by the bees will be valuable for use the next year, and one or more of them put in each super that is first put on the hives will start the bees promptly at work. If they are not cleaned out, the particles of honey remaining will candy and affect the new honey that is put in them the next season.

MOVING BEES.

As has been explained, bees mark their location, and when they return from a foraging expedition they find their place rather than their hive. If you turn a hive around, so as to make the entrance at the back instead of the front, it will trouble the bees very much. They will light in clusters where they think the entrance ought to be, and it will be some time before they find the entrance. If you move the hive a foot to one side, they will hesitate and reconnoitre carefully before entering. If hive A stands three inches or more south of B, and if A be moved to the north side of B, whether it be a few inches or feet, the field bees belonging to A will return to B, because B stands nearer the right *place.* (It is true that a change in the looks of their hive will confuse them a little, but they go by place rather than looks.) But if no other hive is in the yard, and A be moved several feet or several yards, the bees will find it without much difficulty, because it is the only hive.

If a hive be moved a short distance early in the spring, at a time when the bees have not had a flight for a week or more, there will be little trouble about the bees staying by their hive. After the bees have been flying for a few days in succession in the spring, a removal of a few feet or rods would be followed by the loss of many bees that would go back to their old location, but a removal of half a mile would work very well. But in the middle of the harvest, a colony must be moved a mile or more to make it safe.

It will be seen that if a colony is to be moved a mile or more, there will be no trouble about losing bees if the removal is made at any time of the year, and if a colony is moved at any time during the winter or early spring, it does not matter about the distance it is moved. By taking certain precautions, however, a colony may be moved any distance, great or small, without regard to the time of year. Sometimes, we want to move them a short distance at a time of year when they are flying daily, and then we must take some precaution or we shall lose all the field bees from the hive and have them return to the old location. One way is to move them to some place, perhaps two miles distant, and return them two weeks later, when we can place them wherever we like in the yard or on the farm. While that is a sure way, it is not often a very convenient way. Some report good success by putting a board in front of the entrance after they have been moved. Then, instead of flying straight out from the entrance, as they have been accustomed to do, they bump their noses against the board at the entrance, which disconcerts them so much that they stop to examine the place, and thus take their bearings anew. As an aid it is well to change as much as possible the old location so it will not look like home. If a big bundle of straw is put in place of the hive on the old location it will help. Another plan may be more generally successful. Before moving the bees, close the entrance in some way that will allow a little air to enter, perhaps stuffing grass into it. Close the entrance thus in the evening, after the bees have stopped flying, so that all that belong to the hive may be in. You may move the colony in the evening after shutting it up, or any time before opening it the next day. Open it sometime in the forenoon between 9 and 12 o'clock. If the bees are quiet, pound on the hive until you stir them up to making quite a noise; then let them out. There is just a possibility that if the weather is very hot and the colony very strong, the bees might smother unless the entrance be closed with wire cloth, so as to allow of ventilation.

If bees are to be hauled some distance, care must be taken in freezing weather not to break the combs by rough handling, for they are then brittle with the cold. They may be hauled nicely on a sled if the sleighing is good. If hauled in hot weather, the danger is that the combs may be melted down with the heat, or that the bees will smother. Abundant ventilation must be allowed, and abundant ventilation means a great deal in hot weather. Wire cloth over the entire top of the hive will be none too much. Of course the bees must all be fastened in the hive. If bees must be moved in hot weather, it is better to move them at night, because cooler. In any case, the bees must be fastened in the hive after flight has ceased in the evening. If the frames are fixed-distance as most of the latest frames are, they are always ready for moving. If, however, the hive contains loose hanging frames, then there is some danger that the frames may slide in their places and make trouble unless they are fastened in place. This may be done by nailing into each end of each top bar a wire nail, leaving the head up far enough so that it can easily be drawn out. Or, little sticks may be pushed down between the end bars of the frames so as to keep them in place.

A box hive may be turned upside down in moving.

PLANTING FOR HONEY.

Almost surely the farmer who becomes interested in bees will, sooner or later, begin to consider the matter of devoting some ground to the cultivation of plants that will yield honey, and the likelihood is that without any knowledge on the subject he will think that he can plant enough on a fraction of an acre to give plenty of occupation to a colony of bees. The erroneousness of such a view will be seen when it is considered, that taking the State at large, each colony has 50 to 100 acres of ground to work upon. It is now pretty thoroughly understood that there is no plant that can be profitably cultivated for honey alone, at least upon land that can be utilized for any ordinary crop. It is a good plan, however, to encourage the growth of honey plants upon waste places. Perhaps no other plant is so good for this purpose as sweet clover. It is one of the best yields of honey, and will grow on almost any kind of soil. A few seeds scattered along the wayside will grow and increase, and it is better to have the ground occupied thus than by some utterly useless weed. In some places there is a prejudice against it, a prejudice without sufficient ground, for it may remain along the roadside for years and not encroach upon cultivated ground. Moreover, it is a biennial, dying root and branch the second year, and if cut so as to prevent its going to seed it is easily killed out. Where cattle are allowed to run on the roadside, and have become used to it, they will keep it eaten down so it will not become unsightly. But they must first learn to eat it.

Although there is no plant that can be profitably cultivated in good fields for honey alone, the farmer will do well to have an eye to crops worth planting aside from the honey they yield, which will at the same time give a harvest for the bees. But it must be remembered that to be of any service there must be a considerable quantity of any given honey plant. The growth of lindens may be encouraged in preference to trees that yield no honey. As a shade tree along the roadside, the linden is fine. Gooseberries and raspberries are valuable honey plants. Buckwheat is so well known as to be hardly worth mentioning.

Of course there will always be more or less of the great standby, white clover, and it is well to try other clovers. It is claimed that there are strains of bees that do fair work on the second crop of red clover, with its shorter flower tubes. Some effort is being made to breed bees with tongues longer than the average, and if this is succssful, we may yet save the tons of red clover honey that are going to waste.

Alsike clover is very valuable. One trouble is that it blooms at about the same time as white clover, when it is not much needed. If cut in June, just as it begins to blossom, it may be made to bloom later, and thus prolong the harvest.

Crimson clover is especially valuable because coming so early. If yours happens to be one of the localities where it is profitable as a forage crop, or rather where it succeeds well, you will have an additional inducement to cultivate it on account of its honey.

Sweet clover, or melilot, is a plant well worth your while to experiment with. In some places it is highly valued as a forage plant. It is a near relative to the much-vaunted alfalfa, and before the plants are in blossom it may trouble you to tell one from the other. While alfalfa yields tons upon tons of honey in the west, it has never been reported as a honey-yielder in the east, even in the few cases in which it has been successfully cultivated. But sweet clover will flourish anywhere, and upon no other honey plant can you more surely depend for a yearly yield of honey. Stock must learn to eat it, and so they must alfalfa. It has been reported that where the two grew side by side, cows would prefer the sweet clover. You may find that it will be easier to teach stock to eat dry sweet-clover hay than to teach them to eat it in the green state.

Sweet clover is of great value as a fertilizer. When it dies the second winter, as it always does, the long roots rotting away, leave the ground filled with larger and smaller holes. If turned under while green, it gives a dense mass of fertilizing material. It may be used to bring into fine tilth ground useless for almost any other purpose. It will grow in the toughest clay, where perhaps nothing else would grow, leaving the ground in better condition for something else.

Sweet clover does not bloom until the second year, but a crop of hay may be cut from it the first year. It blooms nearly as soon as white clover, and if cut just before coming into bloom it may be made to bloom after white clover is gone. Even without any attention its blooming period lasts after white clover is gone, and sometimes bees may be seen working on it after heavy frosts.

ARTIFICIAL POLLEN.

Generally, bees are able to get all the pollen they need, but sometimes there is a time in the spring when it is nice and warm but there is nothing from which the bees can gather honey or pollen. Pollen is just as necessary for bees as honey, and if there is none in the hive (although there generally is) and nothing to gather it from, no brood will be reared, no matter how strong the colony may be. You may, on such warm spring days, give the bees something as a substitute for pollen, especially if you see them so eager for it that they are working upon the sawdust at the woodpile. They will accept almost any kind of grain ground, chopped corn and oats being a favorite. Whatever ground feed you are giving your horses and cows may be given to the bees. Put in a shallow box, set it out in the open sun, and the bees will find it. Tip the box a little to one side, putting a stone under one side. When the bees have worked the feed down level, reverse the box so the other side will be higher, repeating this throughout the day. When they have worked out all the finer particles, feed the rest to the cows and horses. Even if the bees do not greatly need it, it is worth while to feed it for the sake of seeing them work at it in such a rollicking manner. As soon as they can get the real article, as from hazel, willow or soft maple, you will find your substitute deserted.

OUTDOOR VERSUS INDOOR WINTERING.

It may trouble you a little to decide whether you should winter your bees in the cellar or on the summer stands. It may be well to go by precedent. If you have always wintered successfully in a certain way, by all means continue in that way. If you have had no previous experience, find out how others in your neighborhood have succeeded, and follow the example of the successful ones. It is not the severity of cold so much as its long continuance that is hard on bees. A short spell of 40 degrees below zero is not as bad as several months of 30 degrees above. If, in your locality, you are likely to have spells of continued severe weather so that the bees cannot fly for two or three months at a time, then the cellar may be the best place for you. If, on the other hand, the winters are somewhat open, a day coming every two or three weeks when bees can fly, even if they are sometimes confined a month or so, then they may be better off on their summer stands.

PREPARATION FOR WINTERING.

You *may* prepare bees for wintering in October, but it is very much better to begin earlier. Some say in August is the right time, and in some cases it may be. If all storing is over in August, and the bees are short of stores for winter, then it may be just as well to feed them in August. In any case it is better not to wait later than some time in September. Bees should have plenty of time to get their stores located to suit them and to have all sealed. If any colony is not strong enough to cover four frames, unite it with another. This uniting should not be left until late. If the bees are to be wintered outdoors, 20 to 30 pounds of honey will be needed, say 4 to 6 frames of sealed honey. For the cellar, 3 or 4 well-filled frames may do. Be sure to have enough. Some colonies may not consume half the amount indicated, but you do not know which colonies they are, and it will not be wasted if they have too much. Just as well have something left over so they can begin the sooner in the surplus apartment as to have them wait to fill up the brood-chamber with white-clover honey before they begin in the supers.

If colonies are lacking in stores, give frames of sealed honey if you have them. If you do not have them, give granulated sugar and water, equal parts, using a Miller feeder or the crock-and-plate plan. This kind of feeding is better than to give less water with the sugar, for it is more like the thin nectar the bees gather, and there are changes made in it by the bees which they cannot make so easily on the thicker syrup. But they must have plenty of time to evaporate and ripen this food, and if they cannot have it while warm weather yet lasts, say by the middle of September, then the thicker syrup should be given. If you should be so unfortunate as not to get them fed in time enough to allow them to seal the syrup, then use candy. (See Syrup and Candy, page 29.) Better take pains, however, not to be late about feeding. As an extra inducement to this, it may be mentioned that the earlier feeding with the thinner material tends to make the queen lay, thus having a larger force of young bees to endure the winter and be ready for spring work.

For wintering outdoors, the entrance of the hive should not be more than three-eighth of an inch by eight inches for strong colonies and less for weaker ones. To keep out mice, close the entrance with wire cloth having three meshes to the inch. This will allow the bees to pass, but not the mice. With so small an entrance there is danger of clogging, and this must be guarded against by cleaning out the entrance of it needs it. Some put under the hive a rim an inch or two deep with the entrance at the top of it, and with this there is much less danger of clogging. The hives should not be in a windy place, but sheltered especially from north and west wind. Let them face south or southeast, and put some kind of packing about the hives without closing the entrance, even if nothing more than corn stalks piled up against them. Some use the old-fashioned bee sheds of our grandfathers with good success. The success will be more sure if straw is packed behind and between the hives. Some put over each hive a box large enough to cover it and leave a space of three to six inches all around between the hive and box, packing this space with chaff, dry leaves, planer shavings or something of the kind. Of course the entrance must be kept clear.

One of the things that is bad in winter is too much moisture in the hive. The bees are constantly breathing out moisture, which settles on the cold walls like the moisture of the air on a pitcher of ice water on a hot day. This may form icicles directly over the bees, and when it melts it will fall upon the bees, to their serious injury. Provision may be made for the escape of this moisture elsewhere than at the entrance. Put burlap or some kind of cloth over the top bars with a corn cob under it, so the bees can cross from one frame to another, then cover with three to six inches of leaves, chaff or planer shavings, and put on the cover. This will allow the moisture to escape slowly upward.

OUTDOOR WINTER CARE.

Having provided in advance for the welfare of the bees by making sure that they have plenty of provisions and are warmly tucked up in their winter quarters, and having provided against intrusion of mice and disturbance from domestic animals, there is little to be done for the bees throughout the winter, unless it be to clean the dead bees out of the entrance and to guard against the combined effect of sun and snow.

When the ground is covered with soft snow and the sun shines brightly, the bees will be enticed out by the brightness, dazzled and confused by the snow, and will fall into it never to rise again. If they have had a flight within two or three weeks it may be better for them to remain in the hives, and a board can be placed before the entrance so as not to shut out the air but to shut out the sun. If it is best to let the bees fly, tramp down the snow hard in front of the hives or sweep it away, or else cover the ground with ashes, straw or something to cover the snow.

Do not be alarmed if snow covers the hive, no matter how deep, but sometimes you must look out for it when a small amount falls and the entrance is closed with it, and then it thaws enough to become somewhat solid at the entrance and freezes in that condition. You must clear out the entrance to avoid smothering.

CELLAR WINTERING.

One of the difficult things about cellar wintering is to tell when to take the bees in. There can be no fixed date in the case. One year may be very different from another. Here is a safe rule to follow: At any time after November 10, when the day has been so warm that the bees have had a good flight, carry them into the cellar, if you know they will not be able to fly again for six weeks, but if you know they can fly on some fine day within two or three weeks, leave them out until then. But, alas, who can apply the rule, for who can tell what may be in the next three or six weeks? The best you can do, there must be some guessing in the case. If the bees fly November 10, you are pretty safe in guessing that it is not their last flight, but you would not be so safe in making the same guess November 30. It is better, however, to err on the safe side. Suppose you are in a pretty cold locality, and the bees have had a good flight November 15, and you put them in the cellar the next morning. Then a week later comes a nice, warm day for bees to fly, and you feel foolish and wish you had left them out a week longer. The next fall there comes again a good flight day November 15, but with your greater experience you are not to be caught this time; so you leave them out for the warm day to come a week later. But a week later the warm day does not come; on the contrary, it turns out to be one of those severe winters when the bees will not fly again until spring. About the first to the middle of December you give up hope of a warm day and put the bees in without it. After that you will be likely to make your mistakes on the safe side, and take the bees in too early rather than too late. That extra exposure of the bees for two weeks in weather constantly growing colder was harder on them than twice or three times as long in the warm cellar. It will do no great harm to put the bees in the cellar two or three weeks too soon, but it will do much harm to have them in that much too late.

Possibly you may say, "I think I know how to manage it; be sure to take them in early; then, if a warm day comes, take them out for a flight and take them back again." It would be hard to say why that is not a good plan, but actual practice shows that it does not work well and is not advisable.

Having decided that it is time for the bees to go into the cellar, put them in the evening after their flight, or within a day or two. If there is hard freezing, the hives may be frozen down so that when you crack them up it will stir up the bees badly. Crack them up twelve or twenty-four hours before carrying in, and put a nail under. The hives will be taken into the cellar with the covers on, just as they were on the summer stand. They need no ventilation above, providing they have big ventilation below. But box-hives may be turned upside down so as to have all upward ventilation. It will not make the bees dizzy to stand on their heads.

Unless your bottom boards are so deep as to leave one or two inches space under the bottom bars, it is as well not to carry them in the cellar. But if you do take them in, be sure that there is abundant ventilation below. The hives may be blocked up an inch or more. If you want to take up little room, set a row of hives with, perhaps, ten inches of space between them. Then set a row of hives without any bottom boards over these, each upper hive resting on two of the lower ones. That will leave an open space under each hive, and you may thus pile them up as high as the room will allow. They will take up still less room if your bottom boards are one or two inches (better two inches) deep, for then you can pile each hive directly over another and pack the piles closely together. You will generally find the bees very quiet the next day after having a flight, and if you are careful in handling them they will not be likely to fly out.

If it should happen to be warm for some days after they are in the cellar, leave doors and windows of cellar wide open every night. They may even be left open in day time if you find the bees do not fly out. After the bees are in the cellar, every bee that flies out of the hive is a dead bee, for it never finds its way back to the hive. Bees will find their way back if they crawl out upon the outside of the hive, and you need not be alarmed if sometimes quite a cluster hangs out. When the weather gets cold, whether it be the next day or three weeks later, keep all closed up. Whenever it seems too warm in the cellar, cool off a little at night. Put a thermometer in the cellar, and see at what temperature the bees are most quiet, and after that try to keep the temperature as near that point of quiet as you can. If the cellar is too warm the bees will stir about and be somewhat noisy. If it gets too cold they will make a sort of humming sound in trying to keep warm, and the colder it is the louder the humming. There is a certain point at which they will be neither too cold nor too warm, but almost dormant. It will be somewhere about 45 degrees, but thermometers and cellars vary, and it is better for you to find out for yourself what is the right degree in your cellar with *your* thermometer.

If it should go down below 40 degrees for any length of time, it would be well to try to make it warmer. If you have no stove in the cellar, take down hot stones or jugs of hot water, *corked tight*, But do not use an oil-stove, a lamp, or anything of the kind without having it directly connected with some kind of a pipe or chimney to carry off the smoke or gases.

If mice are in the cellar, close the entrances of the hives by means of wire cloth having three meshes to the inch; this will keep out the mice but will allow the bees to pass. Do not confine the bees to the hive, for when bees are about to die from old age or other causes, it is their nature to leave the hive, and if confined, it is likely to make the other bees in the hive uneasy.

You need not be surprised to see bees come out of the hive to die throughout the winter, and if many colonies are in the cellar it will be necessary to sweep up the dead bees by the first of January, and monthly thereafter.

The quieter the bees are kept in the cellar the better, although it does no particular harm to go into the cellar as often as necessary to get the fruits and vegetables for the use of the family. These same fruits and vegetables should be kept carefully sorted over, and all that are decayed carried out, both for the health of the bees and that of the family.

DAMAGE DONE BY BEES.

Serious charges have been brought against bees, some of them ludicrous enough, such as bees eating young ducks. It is not to be denied that damage of a serious nature may come from the stings of bees. An animal tied close by their hives so that it cannot get away may be attacked and stung to death. An animal at large might be severely stung, but this is a rare occurrence. Some bee-keepers have kept farm stock in the same enclosure with bees summer after summer with no serious results. Occasionally a cow or a horse may get a sting, only to shake its head and run away to another part of the enclosure. It is hardly advisable to let sheep run among the hives, not for any harm to the sheep, but because sheep are worse than horses or cows about pushing hives off their stands. A Wisconsin farmer who kept bees was sued by his neighbor because his bees drove the neighbor's sheep from their white-clover pasture, so that the sheep became poor. Of course the suit was lost, for one needs only a slight acquaintance with bees to know that they are utterly harmless when away from their hives.

A New York bee-keeper was sued because his bees ate the peaches on a neighbor's trees. The suing peach-grower had the pleasure of paying all the costs, for a bee was never known to bite through the skin of a sound peach. It may be remarked here in passing, that in both cases mentioned the sued bee-keeper had the benefit of help from the National Bee-Keepers' Association, of which any bee-keeper may be a member by paying $1.00. Its object is to look out for the interests of bee-keepers, chief among which is the prosecution of those who attempt to defraud the public by selling for honey some fraudulent preparation.

Frequently a grape-grower charges the bees with damaging his crop, and he seems to have a pretty clear case. There are the clusters of grapes covered with bees, and while he keeps his eyes fixed upon them each berry grows smaller and smaller until nothing is left but the skin. But each grape was first pierced by a wasp or bird, and intelligent fruit-growers say they prefer to have the pierced berries emptied by the bees, for they will rapidly sour and decay to the damage of the crop. At a time when no honey is being gathered, and when bees are fierce to get something from any source, take a cluster of grapes and prick half the berries with a pin and lay the cluster in front of a hive. The bees will promptly proceed to clean out the berries that were pierced, but not a sound berry will ever be in the least injured.

Cider mills and sorghum mills are troubled by bees, but the chief damage is to the bee-keeper, as thousand of bees are destroyed, and those that get safely home take with them that which may prove the ruin of the colony the following winter. If the law was appealed to, in consideration of the greater loss to the bee-keeper and the character of the bees as public benefactors in fertilizing the flowers, it is possible that the owner of the cider mill might be compelled to screen in his cider mill against the entrance of the bees.

There is one sort of damage done by bees which, although seldom occurring, it may be as well to know about so as to guard against it. When bees take their first cleansing flight in the spring, as on the day when they are brought out of the cellar, they will, when emptying themselves, spot everything within several rods from their hives. The good woman of the house should avoid having a washing on the line on that first day or she may have her temper so soured that it will take much honey to sweeten it.

Bees are not strict observers of the eighth commandment. In fact, when pasturage is lacking, they have no compunctions as to appropriating the stores of another colony, whether it be a foot or a mile away. When a colony is robbed, the owner of the plundered bees, supposing or knowing that his neighbor's bees are the plunderers, is likely to feel, if he is not acquainted with the habits of bees, that he ought to be paid damages. In reality, the damages ought to go the other way. The morals of bees cannot be changed, and it is their nature to glean wherever they can in time of scarcity. The man who allows honey to be exposed so as to start robbing, or allows a colony to be weak and queenless so as not to be able to defend its stores, is culpable, and the man whose bees have been demoralized by temptations that have started them into dishonest habits from which they will not readily recover, is the injured party. It is not the business of any man to keep his bees from robbing, but it is the business of every man to keep his own bees from being robbed.

BEE LITERATURE.

In the limited compass of this Bulletin it is not possible to give all that should be known by one who desires to be fully informed upon the subject of bee-keeping. There are text-books upon bee-keeping that contain five or ten times as much as this pamphlet, leaving the subject so little exhausted that several periodicals devoted to bee culture have been published for years, each of them forming an annual volume containing a mass of bee-lore equal in volume to one of the text-books. For the benefit of those who desire to pursue the subject further, it may be well to name the leading books and papers.

Root's A B C of Bee Culture is not, as its name might indicate, a primer, but a very comprehensive cyclopedia of everything pertaining to bee culture; in fact no fuller work upon the subject is published in any language in the world. Its nearly 500 large pages are copiously illustrated by engravings, a few specimens of which may be seen in this Bulletin, having been borrowed from that work by the courtesy of its publishers.

Rev. L. L. Langstroth, the inventor of the movable-frame hive, wrote a work upon bee-keeping that is a classic. Written many years ago, it has lately been revised and brought up to the times by Chas. Dadant, a thoroughly practical bee-keeper. The book is called *The Hive and Honey Bee.*

The Bee Keepers' Guide: or, *Manual of the Apiary*, is written by Prof. A. J. Cook. Being a professor of entomology as well as a bee-keeper, he gives prominence to the anatomy and physiology of the bee, followed by a practical treatise on the different subjects pertaining to bee culture.

The following bee journals may be mentioned:

The American Bee Journal, 144 Erie st., Chicago; weekly, $1.00.

Gleanings in Bee Culture, Medina, O.; semi-monthly; $1.00.
The Bee-Keepers' Review, Flint, Mich.; monthly; $1.00.
The American Bee-Keeper, Falconer, N .Y.; monthly, 50 cents.
The Progressive Bee-Keeper, Higginsville, Mo.; monthly; 50 cents.

HONEY COOKING RECIPES.

In any case where honey is used in cooking in place of sugar, it should be remembered that the moisture in the honey makes it necessary that less liquid, as milk or water, should be used. It is especially convenient to have cake made with honey, as well as being more wholesome, for, instead of being good only for a short time while fresh, it may be kept for a long time, some of it for years, and if it becomes hard, close it up for a time in a bread-can or crock and it will regain its freshness.

Honey-Gems.—2 quarts flour, 3 tablespoonfuls melted lard, ¾ pint honey, ½ pint molasses, 4 heaping tablespoonsfuls brown sugar, 1½ level tablespoonsfuls soda, 1 level teaspoonful salt, ⅓ pint water, ½ teaspoonful extract vanilla.

Honey-Jumbles.—2 quarts flour, 3 tablespoonfuls melted lard, 1 pt. honey, ¼ pt. molasses, 1½ level tablespoonfuls soda, 1 level teaspoonful salt, ¼ pt. water, ½ teaspoonful vanilla.

These jumbles and the gems immediately preceding are from recipes used by bakeries and confectioneries on a large scale, one firm in Wisconsin alone using ten tons of honey annually in their manufacture.

Honey-Cake or Cookies without sugar or molasses.—2 cups honey, 1 cup butter, 4 eggs (mix well), 1 cup buttermilk (mix), 1 good quart flour, 1 level teaspoonful soda or saleratus. If it is too thin, stir in a little more flour. If too thin it will fall. It does not want to be as thin as sugar-cake. I use very thick honey. Be sure to use the same cup for measure. Mix the honey, butter and eggs well together. You can make it richer if you wish by using clabbered cream instead of buttermilk. Bake in a rather slow oven, as it burns very easily. To make the cookies, use a little more flour, so that they will roll out well without sticking to the board. Any kind of flavoring will do. I use ground orange peel, mixed soft. It makes a very nice gingerbread.

Howell Honey-Cake.—(It is a hard cake). Take 6 lbs. flour, 3 lbs. honey, 1½ lbs. sugar, 1½ lbs. butter, 6 eggs, ½ oz. saleratus; ginger to your taste. Directions for mixing.—Have the flour in a pan or tray. Pack a cavity in the center. Beat the honey and yolks of eggs together well. Beat the butter and sugar to cream, and put into the cavity in the flour; then add the honey and yolks of the eggs. Mix well with the hand, adding a little at a time, during the mixing, the 1 oz. saleratus dissolved in boiling water until it is all in. Add the ginger, and finally add the whites of the 6 eggs, well beaten. Mix well with the hand to a smooth dough. Divide the dough into 7 equal parts, and roll out like ginger-bread. Bake in ordinary square pans made for pies, from 10x14 tin. After putting into the pans, mark off the top in ½-inch strips with something sharp. Bake an hour in a moderate oven. Be careful not to burn, but bake well. Dissolve sugar to glaze over top of cake. To keep the cake, stand on end in an oak tub, tin can or stone crock—crock is best. Stand the cards up so the flat sides will not touch each other. Cover tight. Keep in a cool dry place. Don't use until three months old at least. The cake improves with age, and will keep as long as you let it. I find any cake sweetened with honey does not dry out like sugar or molasses cake, and age improves or develops the honey flavor.

Aikin's Honey-Cookies.—1 teacupful extracted honey, 1 pint sour cream, scant teaspoonful soda, flavoring if desired, flour to make a soft dough.

Soft Honey-Cake.—1 cup butter, 2 cups honey, 2 eggs, 1 cup sour milk, 2 teaspoonfuls soda, 1 teaspoonful ginger, 1 teaspoonful cinnamon, 4 cups flour.

Ginger Honey-Cake.—1 cup honey, ½ cup butter, or drippings, 1 tablespoonful boiled cider, in half a cup of hot water (or ½ cup sour milk will do instead). Warm these ingredients together, and then add 1 tablespoonful ginger and 1 teaspoonful soda sifted in with flour enough to make a soft batter. Bake in a flat pan.

Fowls' Honey Fruit-Cake.—½ cup butter, ¾ cup honey, ⅓ cup apple jelly or boiled cider, 2 eggs well beaten, 1 teaspoonful soda, 1 teaspoonful each of cinnamon, cloves and nutmeg, 1 teacupful each of raisins and dried currants. Warm the butter, honey and apple jelly slightly, add the beaten eggs, then the soda dissolved in a little warm water; add spices and flour enough to make a stiff batter, then stir in the fruit and bake in a slow oven. Keep in a covered jar several weeks before using.

Muth's Honey-Cakes.—1 gallon honey (dark honey is best), 15 eggs, 3 lbs. sugar (a little more honey in its place may be better), 1½ oz. baking soda, 2 oz. ammonia, 2 lbs. almonds, chopped up, 2 lbs. citron, 4 oz. cinnamon, 2 oz. cloves, 2 oz. mace, 18 lbs. flour. Let the honey come almost to a boil; then let it cool off, and add the other ingredients. Cut out and bake. The cakes are to be frosted afterward with sugar and white of eggs.

Fowls' Honey Layer-Cake.—⅔ cup butter, 1 cup honey, 3 eggs beaten, ½ cup milk. Cream the honey and butter together, and add the eggs and milk. Then add 2 cups flour containing 1½ teaspoonfuls baking powder previously stirred in. Then stir in flour to make a stiff batter. Bake in jelly tins. When the cakes are cold, take finely flavored candied honey, and after creaming them, spread between layers.

Fowls' Honey-Cookies.—3 teaspoonfuls soda dissolved in 2 cups warm honey, 1 cup shortening containing salt, 2 teaspoonfuls ginger, 1 cup hot water, flour sufficient to roll.

Honey Nut-Cakes.—8 cups sugar, 2 cups honey, 4 cups milk or water, 1 lb. almonds, 1 lb. English walnuts, 3 cents' worth each of candied lemon and orange peel, 5 cents' worth citron (the last three cut fine), 2 large tablespoonfuls soda, 2 teaspoonfuls cinnamon, 2 teaspoonfuls ground cloves. Put the milk, sugar and honey on the stove, to boil 15 minutes; skim off the scum, and take from the stove. Put in the nuts, spices and candied fruit. Stir in as much flour as can be done with a spoon. Set away to cool, then mix in the soda (don't make the dough too stiff). Cover up and let stand over night, then work in flour enough to make a stiff dough. Bake when you get ready. It is well to let it stand a few days, as it will not stick so badly. Roll out a little thicker than a common cookie; cut in any shape you like.

This recipe originated in Germany, is old and tried, and the cake will keep a year or more.

Honey Drop-Cakes.—1 cup honey, ½ cup sugar, ½ cup butter or lard, ½ cup sour milk, 1 egg, ½ tablespoonful soda, 4 cups sifted flour.

Honey Short-Cake.—3 cups flour, 2 teaspoonfuls baking powder, 1 teaspoonful salt, ½ cup shortening, 1½ cups sweet milk. Roll quickly, and bake in a hot oven. When done, split the cake and spread the lower half thinly with butter, and the upper half with ½ pound of the best flavored honey. (Candied honey is preferred. If too hard to spread well it should be slightly warmed or creamed with a knife.) Let it stand a few minutes, and the honey will melt gradually and the flavor will permeate all through the cake. To be eaten with milk.

Honey Tea-Cake.—1 cup honey, ½ cup sour cream, 2 eggs, ½ cup butter, 2 cups flour, scant ½ teaspoonful soda, 1 tablespoonful cream of tartar. Bake thirty minutes in a moderate oven.

Honey Ginger-Snaps.—1 pint honey, ¾ lb. butter, 2 teaspoonfuls ginger. Boil together a few minutes, and when nearly cold put in flour until it is stiff. Boil out thin, and bake quickly.

Honey Fruit-Cake.—1½ cups honey, ⅔ cup butter, ½ cup sweet milk, 2 eggs well beaten, 3 cups flour, 2 teaspoonfuls baking powder, 2 cups raisins, 1 teaspoonful each of cloves and cinnamon.

Honey Pop-Corn Balls.—Take 1 pt. extracted honey, put it into an iron frying-pan and boil until very thick, then stir in freshly popped corn, and when cold mold into balls.

Honey Caramels.—1 cup extracted honey of best flavor, 1 cup granulated sugar, 3 tablespoonfuls sweet cream or milk. Boil to "soft crack," or until it hardens when dropped into cold water, but not too brittle—just so it will form into a soft ball when taken in the fingers. Pour into a greased dish, stirring in a teaspoonful extract of vanilla just before taking off. Let it be one-half or three-fourths of an inch deep in the dish, and as it cools cut into squares and wrap each square in paraffin paper, such as grocers wrap butter in. To make chocolate caramels, add to the foregoing 1 tablespoonful melted chocolate, just before taking off the stove, stirring it in well. For chocolate caramels it is not so important that the honey be of best quality.

Honey Apple-Butter.—1 gallon good cooking apples, 1 quart honey, 1 quart honey vinegar, 1 heaping teaspoonful ground cinnamon. Cook several hours, stirring often to prevent burning. If the vinegar is very strong, use part water.

Honey and Tar Cough Cure.—Put 1 tablespoonful liquid tar into a shallow tin dish and place it in boiling water until the tar is hot. To this add a pint of extracted honey and stir well for half an hour, adding to it a level teaspoonful pulverized borax. Keep well corked in a bottle. Dose, teaspoonful every one, two or three hours, according to severity of cough.

Summer Honey Drink.—1 spoonful fruit juice and 1 spoonful honey in ½ glass water; stir in as much soda as will lie on a silver dime, and then stir in half as much tartaric acid, and drink at once.

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